INTER-COMPANY CORRESPONDENCE-12 CENTRAL FILES

Union Carbide Nuclear Companion Companion

Division of Union Carbide Corporation

J. D. McLendon, Y12RC

J. M. Case To:

Building 9212

Y-12 Plant:

April 18, 1958 Date:

Copies To: J. P. Murray

G. A. Strasser

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Subject: March Health Physics Report -

Mechanical Operations Division

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Index No. Y-B94-37

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Contained in this report is a summary of the activities of the Health Physics Department in the Mechanical Operations Areas during this report period. This report is issued for the purpose of providing information that will aid you in evaluating the effectiveness of the Health Physics control measures in the involved areas.

AIR ANALYSES

GENERAL AIR

For determining the levels of uranium air concentrations within your areas, permanent air monitors are maintained by the Health Physics Department. The following table presents the results obtained from these monitors during March, 1958. Attached are schematic drawings which show the average U-air concentration at each sampler location and graphs which show area day averages for several previous months. The Maximum Permissible Limit (MPL) for uranium in air is 70 d/m/M3.

Table I General Air

	Time of	No. of	% of S:	amples PL	Avg. U-A (d/m	/M ³)
Area and Area Location	Sample	Samples	Mar.	Feb.	Mar.	Feb.
H-1 Foundry	Day Night	288 128	11 1	11 21	37 19	43 67
Bldg. 9212 and F Area	Day Night	211 40	0 0	. 0	5 2	6 4
E-Wing Machine Shop	Day Night	240 227	20 6	51 18	59 23	141 46
M-Wing Machine Shop	Day	160	0	0	3	4
H-2 Wing Machine Shop	Day	119	0	0	4	5
Machine Shop	Day	65	0	0	5	5
Beta 4 Machine Shop	Day	40	0		3	
O-Wing Rolling Mill	Day ¹ Night	234 65	39 15	1 1	93 48	11 12
Beta 4 Fabrication	Day	116	5		18	
Exhaust System	Day Night	35 28	3 0	5 0	14 11	25 6
M-Wing Exhaust System	Day	40	10	36	19	42
O-Wing Exhaust System	Night	108	0	0	1	2
TOTALS		2,144	9	12	19	33

As revealed by the attached O-Wing schematic drawing, permanent air monitor #4 (averaged 263 d/m/M³ with 94% of the samples exceeding the MPL) made the greatest contribution to this increase in the day general air results. The removing of plates from the rolling and forming line hood into the open room near this location accounts for these samples showing high levels of uranium air concentration.

SPECIAL ENVIRONMENTAL SAMPLES

Air samples of this type are collected within certain areas or locations where permanent air samplers are not installed for evaluating the degree of air-borne contamination at these specific areas. Results from these samples are summarized in the following table.

Table II
Special Environmental Air Samples

Area and Location	No. of Samples	_	Avg. Time (Min.)	Avg. U-Air Conc. (d/m/M ³)
(G. A. at random locations throughout the designated area)		•		
G-1, packing and shipping	11	0	60	6
G-2,	11	0	72	3
G-1,	9	0	71	6
G-3, basement packing and shipping	10	0	43	6
G-3,	8	0	40	12
A-1 Wing	9	11	333	27
O-Wing Rolling Mill - parts storage area	6	67	60	84

These samples were obtained upon the request of area supervision to determine the effectiveness of present health physics control measures. The above results indicate that personnel are properly protected from uranium air concentrations, however, it should be pointed out that no grinding operations were being performed when these samples were obtained and were done infrequently.

BREATHING ZONE AND OPERATIONAL SAMPLES

Breathing zone and operational samples are collected for the purpose of determining the levels of atmospheric contaminants to which an employee may be exposed while performing certain operations. Other purposes of these samples are to locate the operations showing high air levels and to evaluate the effectiveness of control measures. The following table summarizes the results of the samples collected during this report period. Unless otherwise indicated, the samples are of the breathing zone type.

Table III

Breathing Zone and Operational Samples

Area and Operation	No. of Samples	No. of Samples > MPL	Avg. Time (Min.)	Avg. U-Air Conc. (d/m/M ³)
Machining Area	Samples			
Ţ.				
A-1 Machine Shop				
Taking cuts	4	0	6	26
Oper., at new saw hood while sawing slugs	9	1	20	27
B-Wing				
Taking cuts at machine # 526	6	3	3	82
Sawing, sanding and/or burring part in open room (respirator worn)	3	2	7	89
H-2 Machine Shop				
Drilling parts	3	1	3	54 -
Polishing and/or removing burrs at hood	22	8	5	68
E-Wing Machine Shop				
Taking cuts and polishing and/or removing burrs	10	9	5	103

- continued -

Table II	T (con	tinu	(be
Table H	7 (COII	بمالللها,	-u ,

Table III (continued) No. of No. of Samples Avg. Time Avg. U-Air Conc.						
	No. of		Avg. Time	Avg. U-Air Conc.		
Area and Operation	Samples	> MPL	(Min.)	(d/m/M ³)		
M-Wing Machine Shop						
Taking cuts	17	1	14	17		
Polishing and/or removing burrs at machine i	13	6	4	1,475		
Polishing and/or removing burrs at new hood	5	O <u>.</u>	8	38		
Facing parts	3	. 0	3	36		
Machine Shop						
Taking cuts	2	0	17	4 1		
Polishing	2	0	10	13		
H-1 Foundry						
Hand scraping molds on ventilated dolly	6	4	3	193		
Coating molds on ventilated dolly	5	2	3	63		
Oper., 1" from acid bath while pickling parts ²	4	3	10	3,622		

⁻ continued -

By excluding one exceptionally high sample of 9,599 d/m/M3 from the above 1 results, the average would be reduced to 115 d/m/M3. Hood ventilation at this operation has been increased, therefore, future analyses should show lower levels.

Air analysis obtained at the above location is more representative of the degree 2 of contamination escaping from the acid bath than it is of an exposure level to involved personnel. Breathing level samples will be taken to determine if operating personnel are being subjected to excessive levels of uranium air concentrations.

Table III (continued)							
Area and Operation	No. of Samples	_	Avg. Time (Min.)	Avg. U-Air Conc. (d/m/M ³)			
G-3 ((*					
Buffing uranium on table (local ventilation present) ¹	3	2	4	231			
O-Wing Rolling Mill ²							
Oper., salt bath annealing	3	1	4 8	54			
Water scrubbing billets	24	24	8	1,367			
Circle shearing	8	8	2	630			
Pre-hydroform lubrication	6	6	3	4 81			
Hydroforming	6	6	4	134			
Oper., shape annealing	7	5	3 2	228			
Restrike	3	2	3	83			
Finish cleaning	30	30	4	3,094			
Cleaning and removing plates from storage station into stainless containers	5	5	3	4,117			

⁻ continued -

¹ Samples obtained at the operation "buffing uranium" show atmospheric contaminants above the maximum permissible concentration. According to area personnel, plans have been made to improve local ventilation at the operation.

² Ninety-two per cent of all operational and breathing zone samples obtained from within the O-Wing Rolling Mill Area exceeded the MPL. Such concentrations for an extended period could conceivably result in high uranium urinalysis results to many of the involved personnel. It is suggested that opening and closing of the rolling and forming line hood and the handling of materials or equipment in the open room be kept at a minimum. Also the adequacy of present ventilation should be reviewed. Respiratory protective equipment is not normally used at the above operations.

Table III (continued)						
	No. of	No. of Samples	Avg. Time	Avg. U-Air Conc.		
Area and Operation	Samples	> MPL	(Min.)	$(d/m/M^3)$		
O-Wing Rolling Mill (cont'd) ¹						
Loading plates into baskets and transferring into salt bath	3	3	2	277		
Weighing brims and/or billets at dispatcher's desk	3	1 .	11	60		
Shearing scrap within hood	5	5	9	210		
30" from open door while checking billets after going through mill	3	3	4	518		
Oiling parts on un- ventilated table	22	22	3	7,178		
Oper., east side of scrap shearing hood while shearing	4	1	10	51		

¹ Ninety-two per cent of all operational and breathing zone samples obtained from within the O-Wing Rolling Mill Area exceeded the MPL. Such concentrations for an extended period could conceivably result in high uranium urinalysis results to many of the involved personnel. It is suggested that opening and closing of the rolling and forming line hood and the handling of materials or equipment in the open room be kept at a minimum. Also the adequacy of present ventilation should be reviewed. Respiratory protective equipment is not normally used at the above operations.

REMOVABLE SURFACE CONTAMINATION

The results obtained from the routine smear surveys indicate the degree of removable surface contamination and furnish information as to the effectiveness of house-keeping practices. They may also have a direct relation to the air levels obtained from the permanent air monitors. A summation of the smears obtained during March, 1958, is submitted in the following table. The control criterion (CC) for removable surface contamination is 500 d/m/100cm².

Table IV

Removable Surface Contamination

	No. of	% of Smears	Average d/	m/100cm ²
Area	Smears	> CC	March	February
H-1 Foundry	50	30	462	393
E-Wing Machine Shop	96	3 2	542	528
M-Wing Machine Shop	136	20	363	300
H-2 Machine Shop	26	0	134	145
Machine Shop	35	17	383	399
O-Wing Rolling Mill ¹	378	59	1,966	570
E-Wing Coffee Room	59	22	354	241
M-Wing Coffee Room	10	10	241	338
M-Wing Machine Shop Office	25	4	122	
9996 Urine Collection Station	10	0	10	11
9998 Urine Collection Station	9	0	63	14

⁻ continued -

The removable surface contamination surveys from with this area show a significant increase in the average levels over those of the foregoing period. If these concentrations are to be maintained at or below the CC, continued emphasis must be made on good housekeeping practices and operating technique. These levels of contamination may make a notable contribution to air-borne contaminants.

Table IV (continued)	No. of	% of Smears	Average d/m	1/100cm ²
Area	Smears	> CC	March	February
.9215 Urine Collection Station	10	10	170	67
9215 Lunch Room	25	0	129	92
Beta 4 Machine Shop	15	0	58	
Beta 4 Fabrication	25	4	184	
Beta 4 Annealing	10	0 .	36	
			Present Quarter	Previous Quarter
A-1 Machine Shop	50	0	105	54
A-2 Machine Shop	50	0	137	50
B-Wing Machine Shop	50	4	157	71
F-Area Machine Shop	49	2	107	42
G-1 Packing and Shipping	50	0	50	40
G-2	50	0	. 41	32
G-3 Basement Packing and Shipping	50	0	52	33
G-3 [13	0	63	

DIRECT RADIATION

The following table gives a summary of the external radiation received by persons working in the areas indicated. It is noted that all areas show average levels well below the MPL, and that there were no weekly overexposures for the month of March, 1958.

Table V

External Radiation Exposure

Dept.	No. of Badges	Avg. Exp., Avg. Mrem/Week for Last Quarter	No. of Badges Above the Weekly MPL of 600 Mrem/Wk.	No. of Persons Above the Quarterly MPL of 7800 Mrem
2702	167	64	0	0
2703	728	58	0	0
2793	134	25	0	0
2701	219	68	0	0
2665	173	49	0	0
2618	101	99	0	0

URINALYSES

Personnel working in uranium handling areas are requested to submit urine samples periodically. By analyzing this urine for uranium, an estimate of the internal exposure of these people is obtained. The following table gives a resume' of the cumulative uranium urinalysis results for the Mechanical Operations Division personnel during the report period. The quarterly cumulative results referred to are for the 13-week period ending March 26, 1958. Attached are graphs which show the average levels for previous report periods.

Table VI
Urine Samples

Dept. No.	No. of Samples Analyzed	No. of Samples > 43 Mrem/Day	No. of Persons > 3900 Mrem/Qtr.	Average Mrem/Qtr.
2618	34	1 -	0	785
2665	53	4	1	1,283
2701	22	0	0	571
2702	48	4	1	1,315
2703	111 .	2	1	501
2718	77	7	0	1,419
2742	5	0	o	819
2776	112	2	o	828
2793	87	2	1	819
Totals	549 ·	22	4	768

The following table gives a breakdown on the urine program participation during this report period.

Table VIII
Urinalysis Program Participation

Dept.	No. of Persons Scheduled	No. of Voidings Scheduled	% of Voidings Given as Scheduled	% of Voidings Given at Other Times
2618	24	29	76	41
2665	21	84	92	0
2701	18	21	81	24
2702	40	52	91	2
2703	194	208	57	0
2718	27	108	95	0
2742	2	8	75	0
2776	52	196	80	0
2793	35	138	86	0
Totals	413	844	79	2

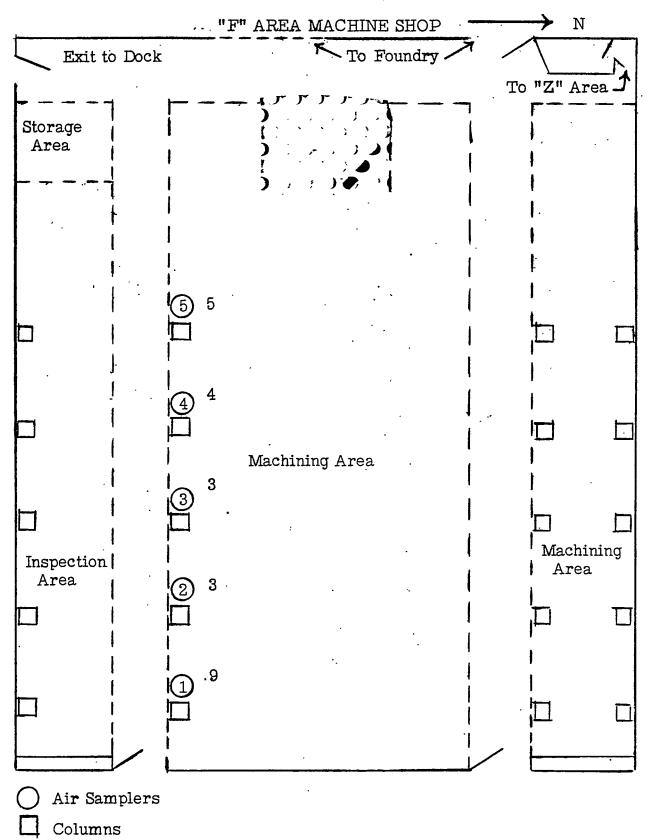
This shows an overall participation effort of 80% for the Mechanical Operations Division which is considered satisfactory. Departments 2618, 2665, 2702 and 2718 should be commended for their excellent overall participation effort. Departments 2701, 2776 and 2793 fall into the satisfactory range, while Departments 2703 and 2742 are in the unsatisfactory range. It should be noted that there was a misunderstanding concerning the change in participation schedule for Department 2703.

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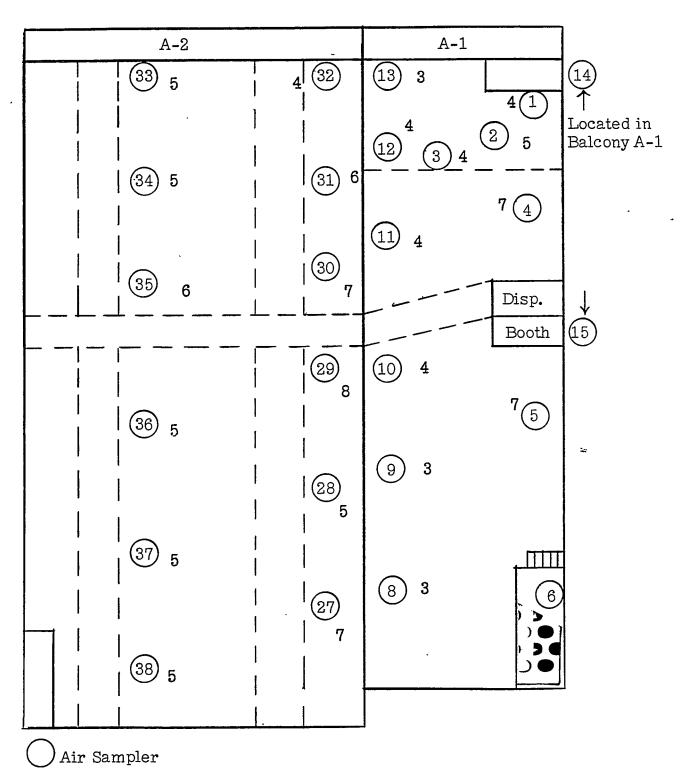
Attachments

J.D. McLendon

March, 1958



March, 1958
A-Wing Machine Shops



Day Averages of Uranium General Air Sampler Results (d/m/ M^3) March, 1958 E-Wing Machine Shop

N	X-10 	X-11 \(\bigcup_{\text{26}}\) 66	X-12 	X-13	X-14 (28) 130
	63 V-10 Office Coffee Room	60 V-11 \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	37 30 V-12 35 50	29 V-13 D 28 36 37	V-14 □ 34

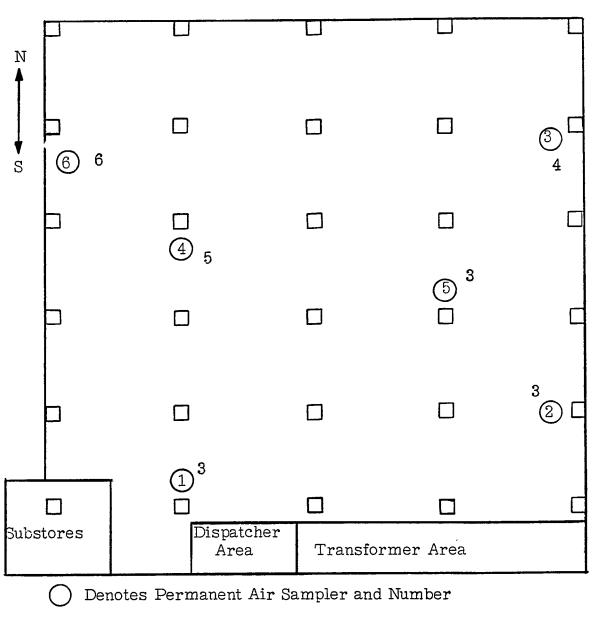
Column .

Air Sampler

Day Averages of Uranium General Air Sampler Results (d/m/M³)

March, 1958

H-2 Wing Machine Shop

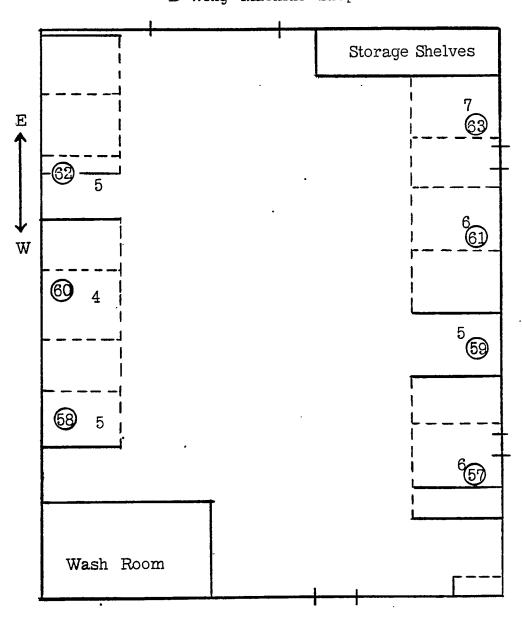


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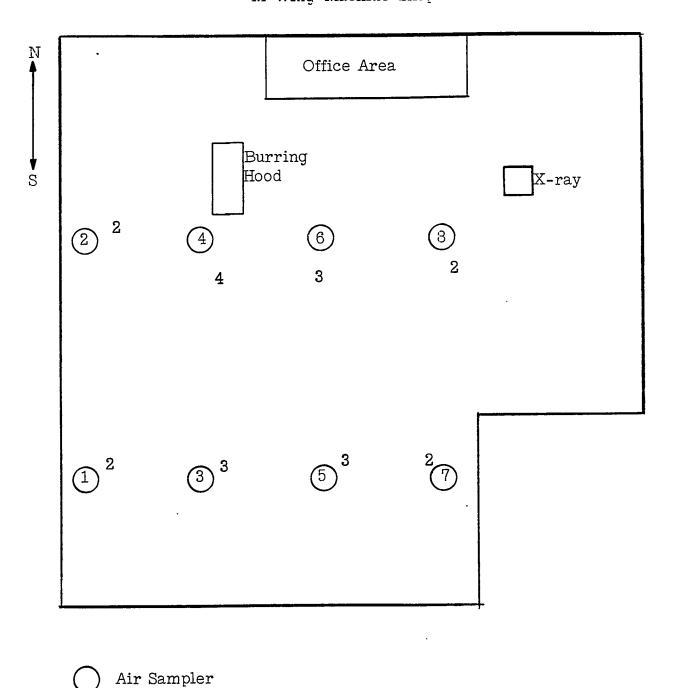
Day Averages of Uranium General Air Sampler Results (d/m/M³)

March, 1958

B-Wing Machine Shop

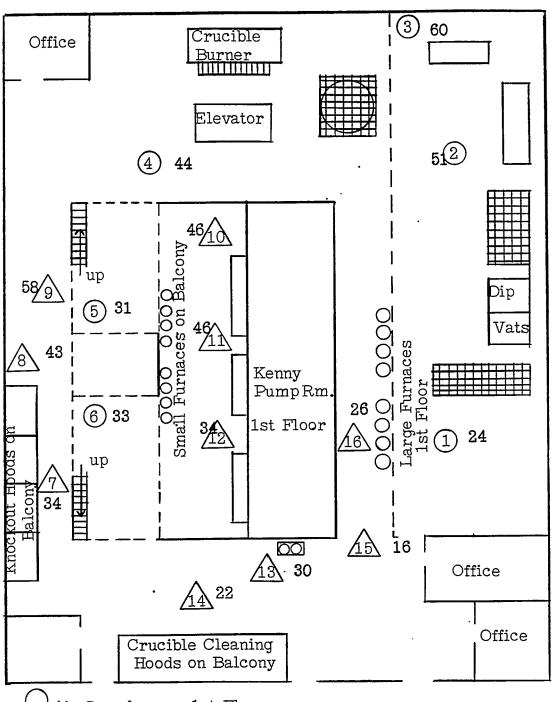


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Day Averages of Uranium General Air Sampler Results (d/m/M³)

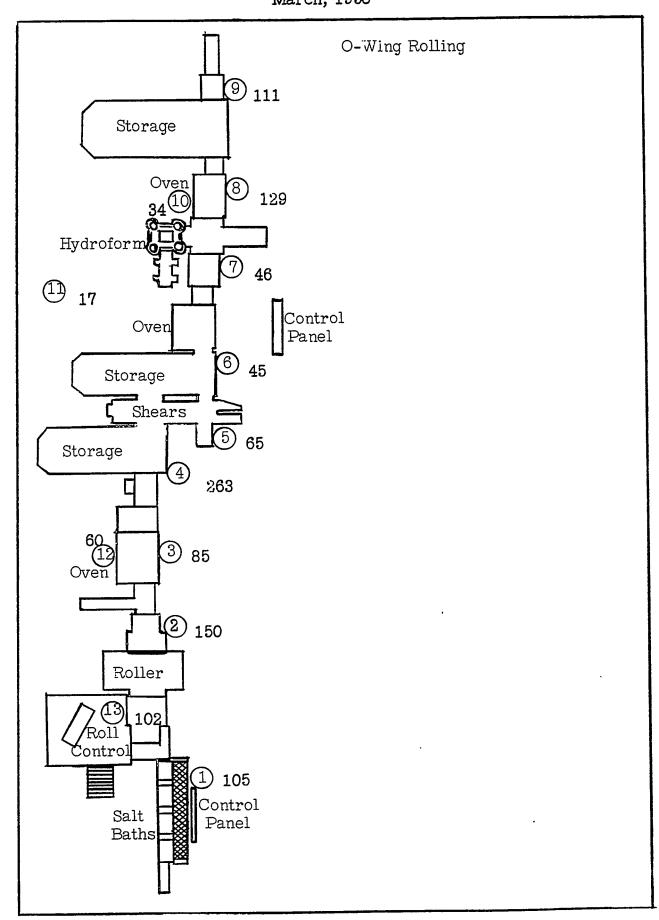
March, 1958 H-1 FOUNDRY



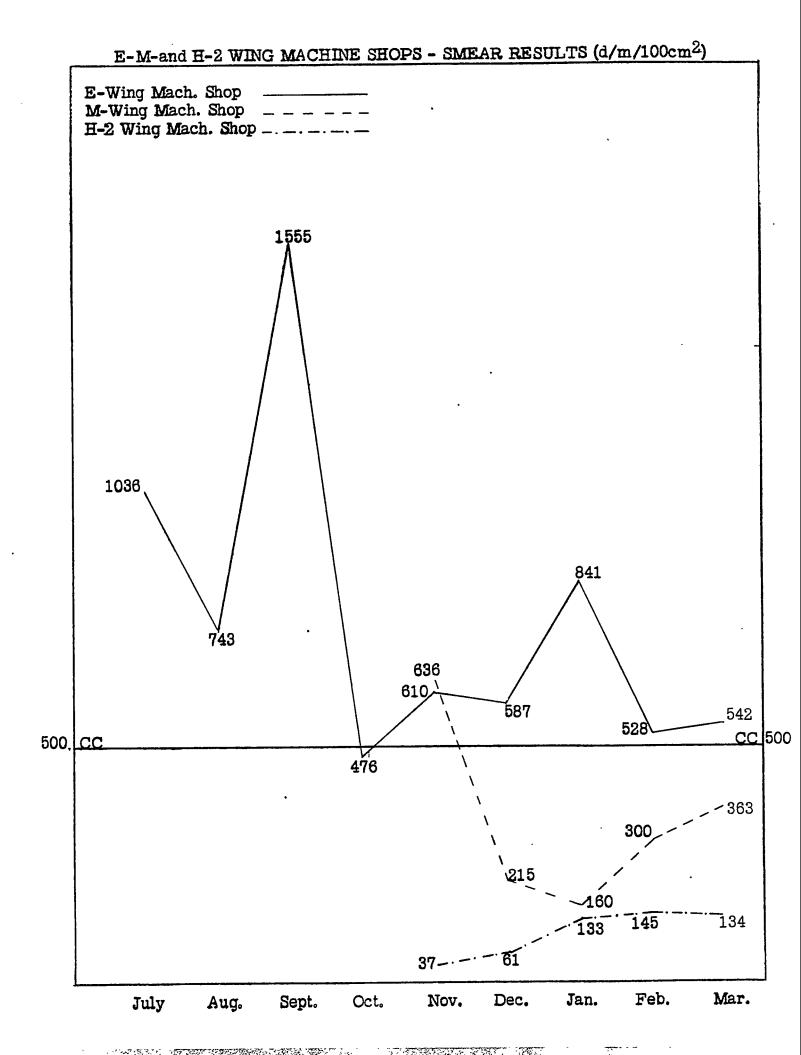
igwedge Air Samplers on 1st Floor. igwedge Air Samplers on 2nd Floor.

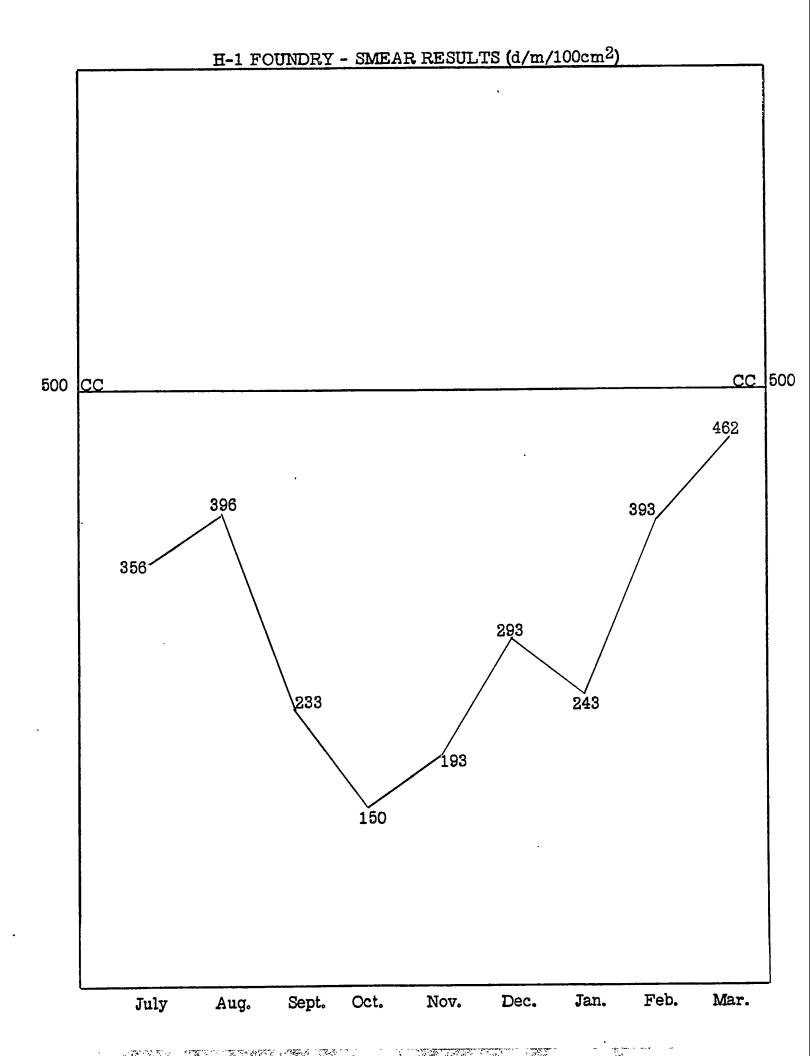
Day Averages of Uranium General Air Sampler Results ($d/m/M^3$)

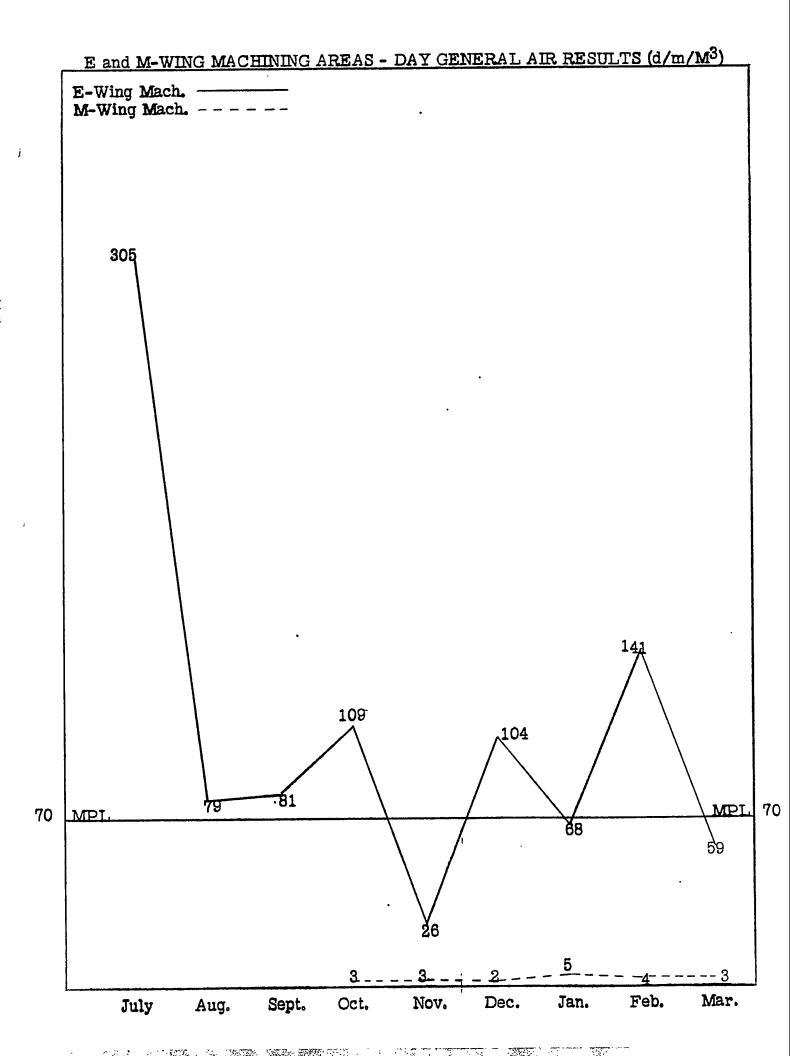
March, 1958

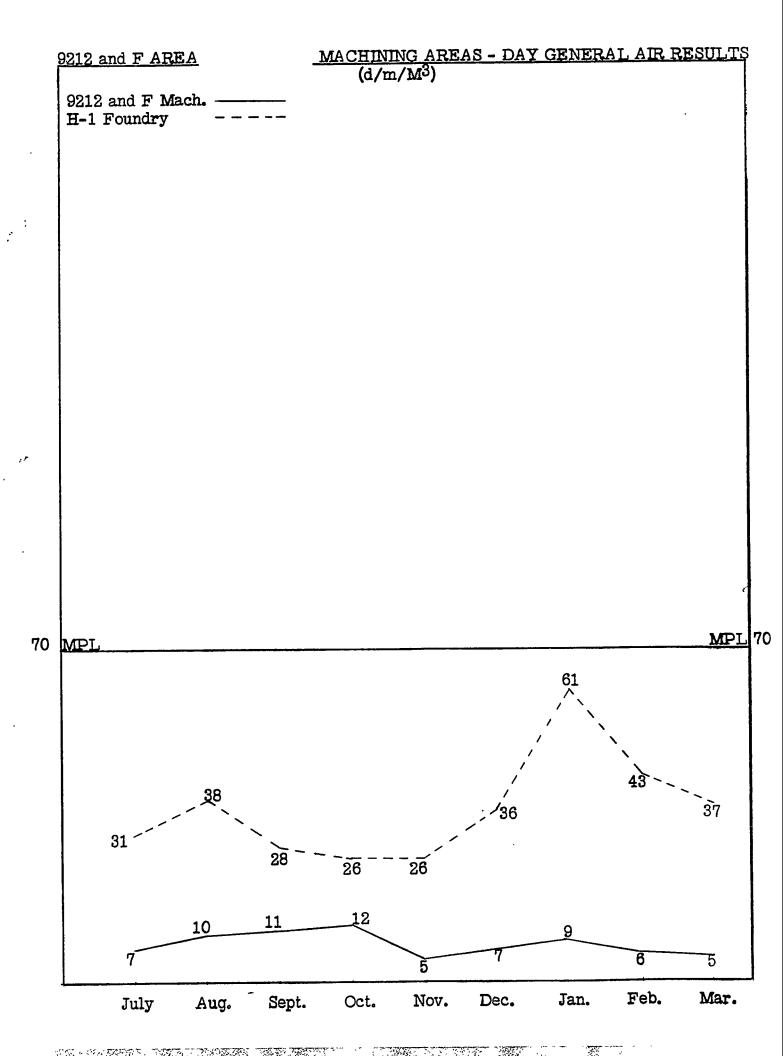


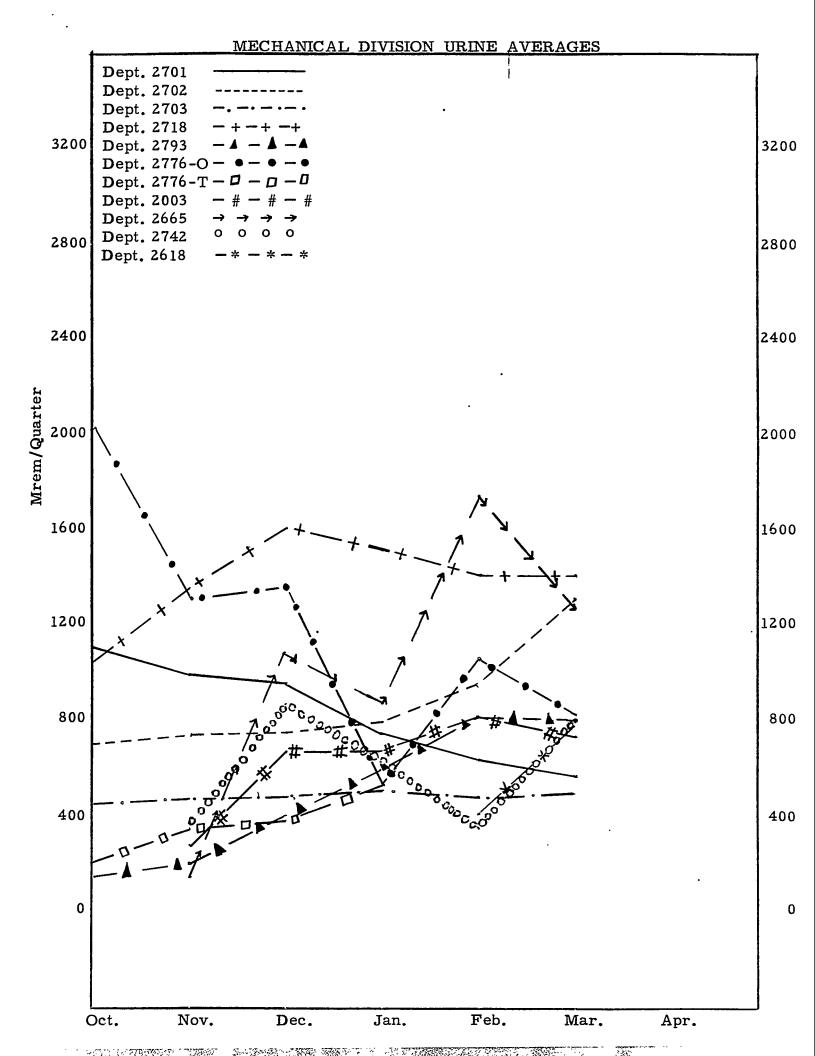
Air Sampler











INTER-COMPANY CORRESPONDENCE Y-12 GENTRAL FILES

UNION CARBIDE NUCLEAR COMPANY CORNEL OF The Carbide Corneration

Division of Union Carbide Corporation

Cy. 1

To:

F. M. Tench

Y-12 Plant:

Building 9212

Date:

April 18, 1958

Copies To: J. P. Murray

W. E. Heckert

Subject: March Health Physics Report -

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Index No. Y-B94-36

J. F. Morehead

W. S. Wallace W. K. Whitson, Jr.

J. D. McLendon, Y12RC

Submitted in this report is a resume' of the activities of the Health Physics Department for the Product Chemical Areas of Building 9212 for the month of March, 1958. The purpose of this report is to present you with information which might aid in your evaluation of the effectiveness of the measures taken to protect personnel against the health hazards associated with the handling of uranium.

AIR ANALYSES

GENERAL AIR

Permanent air monitors are maintained by the Health Physics group for determining levels of uranium air concentrations within most of the operating areas under your supervision. This type of sample records the level of atmospheric contaminants within the room sampled. The following table presents the results from these monitors for this report period. For comparable information for previous periods, reference is made to the included data and to attached graphs. The attached schematic drawings or tables show the day average U-air level at each air sample station. Generally speaking, the day samples show a higher level of air-borne contamination than the night samples. Consequently, in future reports individual day and night graphs will be included in order to present a complete picture of 24-hour operations. The Maximum Permissible Limit (MPL) for uranium in air is 70 d/m/M3.

Table I General Air

	Time of	No. of	% of Sa > MI	_	Avg. U-Ai (d/m/l	
Area and Area Location	Sample	Samples	Mar.	Feb.	Mar.	Feb.
Line Production						
Dry Chemistry ¹	Day Night	118 96	25 33	30 34	67 76	75 116
Reduction ²	Day Night	200 1 4 9	69 58	67 57	173 162	188 163
Casting	Day ³ Night	160 152	44 10	77 58	135 31	1 6 5 115
Plating Room	Day	40	8	5	23	19
Pickling Room	Day	20	25	25	59	57

- continued -

- General air results from within this area continue on the downward trend, however, air monitor No. 1 (located in the blending room) remains well above the MPL. By excluding the results obtained at this sampler, the day and night averages would be further reduced to 49 and 58 d/m/M³ respectively. Ninety-seven per cent of these samples show high levels of uranium air concentrations. Area personnel has attempted to lower air-borne contaminants at this sampler station by installing a deflection shield over the blending room supply air duct, thereby giving more complete air distribution.
- Permanent air monitor results in this area continue to be extremely high. Since sixty-four per cent of the samples show excessive levels of air-borne contaminants (eighteen of the twenty area averages for this month exceeded the MPL), it is believed that these unsatisfactory concentrations are due to general conditions rather than specific operations.
- The above day general air results would be reduced to 59 d/m/M³ if the analyses obtained at monitors Nos. 13 and 18 (located in the dry box area) were omitted from the above average. Ninety per cent of the samples taken at these two locations exceeded the MPL and had an overall average of 363 d/m/M³. Supervision hopes to improve on these unsatisfactory air levels by altering the general and local ventilation so as to give a more even distribution of supply air throughout the area as well as maintain a constant exhaust within the dry boxes.

Table I (continued)							
			% of Samples		Avg. U-Air	Conc.	
	Time of	No. of	> MF		(d/m/M		
Area and Area Location	Sample	Samples	Mar.	Feb.	Mar.	Feb.	
Line Production (cont'd.)		·					
Special Alloy Casting	Day ¹ Night	40 30	75 17	45 42	195 41	87 58	
Salvage							
Head House	Day Night	159 127	. 25 27	24 48	68 - 73	88 182	
C-Wing	Day Night	139 49	2 4	11 7	16 22	29 26	
B-1 Wing	Day Night	156 45	14 13		84 34		
Special Processing							
UO ₂ Production	Day Night	126 128	11 5	8 12	33 25	31 29	
E-Wing Laboratory .	Day Night	100 40	2 3	2 0	12 13	13 12	
Room 1008	Day Night	38 16	5 6	57 42	29 30	98 123	
TOTALS		2,128	26	36			

¹ The operations "loading casters, unloading casters, and transferring parts or materials from casters to hood" are believed to be primarily responsible for the high day air results. Operational and breathing zone samples are planned so as to better evaluate this situation. Operating techniques have been revised in an effort to improve on these air levels.

SPECIAL ENVIRONMENTAL AIR SAMPLES

In the absence of permanent air monitors within an area, general air samples are collected by the use of portable sampling equipment for estimating the levels of atmospheric contamination. The data obtained during the month of March, 1958, are summarized in the following table.

Table II Special Environmental Samples

Area* and Location	No. of Samples	No. of Samples > MPL	Avg. Time (Min.)	Avg. U-Air Conc (d/m/M ³)
D-Wing Alloy				
G. A., center of south wall	11	1	3 9	33
E-Wing Packing and Shipping				
G. A., at random locations	7	1	45	37
Parts Storage				
G. A., at random locations	5	0	65	24

^{*}Special environmental samples obtained from within these areas indicate the general air concentrations to be of a satisfactory level.

Air samples from uranium chemical stacks are collected to evaluate their contributions of radioactive contaminants to the environs of the plant. These measurements are also valuable as an index of the material loss to the atmosphere. A summation of the results obtained from the Product Chemical exhaust stacks is given in the following table.

Table III

Permanent Stack Samples

	Time of	No. of	No. of Samples	Avg. U-A	
Area and Location	Sample	Samples	> MPL	Mar.	Feb.
E-Wing exhaust stack	Day	20	1	43	55
	Night	16	0	6	13
C-Wing cast iron stack	Day	16	4	44	44
	Night	10	1	29	49
D-Wing cast iron stack	Day	20	1	35	33
	Night	15	5	100	362
Dry Chemistry exhaust	Day	18	1	14	4
duct	Night	14	0	5	6
Head House exhaust duct	Day Night	18 14	2 3	53 52	86 106
UO ₂ Production exhaust duct	Day	18	6	54	19
	Night	14	2	39	26

BREATHING ZONE AND OPERATIONAL SAMPLES

Operational and breathing zone samples are taken over a measured period of time at operations where possibilities of air-borne contamination exist. Both types of samples give estimates of the contamination levels encountered by personnel working at the operation designated. The following tables summarize the results of these samples collected in the Product Chemical Areas of 9212 for this reporting period. Unless otherwise indicated, these samples are of the breathing zone type.

Table IV

Line Production Areas - Breathing Zone and Operational Samples

Area and Description	No. of Samples	No. of Samples > MPL	Avg. Time (Min.)	Avg. U-Air Conc. (d/m/M ³)
E-Wing Reduction ¹				
Securing reactor lids	20	20	2	698
Cleaning buttons	5	5	5	175
Transferring batch to reactor	35	26	20	137
Dry Chemistry ¹				
Oper., processing and removing batch	8	2	51	91
Blending mill lots	9	9	4	175 ·
Cleaning and removing mill lot containers	5	5	1	593

⁻ continued -

Samples obtained in the Dry Chemistry and Reduction areas were taken to aid supervision in determining the actions necessary to improve on air contamination problems within the area. In view of the above results, area supervision has made changes in operating techniques, eliminated filter and dry box leaks, and made plans to improve local ventilation.

Table IV (continued)

Table IV (continued)	No. of	No. of Samples	Avg. Time	Avg. U-Air Conc.
Area and Description	Samples	•	(Min.)	$(d/m/M^3)$
Casting				·
Dismantling part from mold 1	8	8	6	4 27
Scraping and cleaning rod and crucible ¹	4	4	13	581
Chemical Machining Operations				
Breaking buttons ¹	4	4	5	1,461
Packing and Shipping		•		
Sifting and separating pellets ²	3	3	5	5,390
Packing and preparing pellets for shipment ²	3	3	5	3,156

A high percentage of the samples taken at these operations during the past several months have shown uranium air concentrations greater than the MPL. Perhaps present facilities and operating techniques should be reviewed to determine their adequacy for controlling air levels at these types of operations.

Samples obtained at these infrequently performed operations (approximately three hours per week) show air-borne contaminants greater than the maximum permissible concentration. According to area personnel, the above sifting and packing operations are to be performed within a ventilated hood.

Table V Salvage Areas - Breathing Zone and Operational Samples

				· · · · · · · · · · · · · · · · · · ·
	No. of	No. of Samples		Avg. U-Air Conc.
Area and Description	Samples	> MPL	(Min.)	$(d/m/M^3)$
- Head House				
Batching E-Wing sand in open-face hood ¹	3	3	7	474
Oper., at DDU while burning	3	1	32	50
C-Wing				
Oper., precipitating uranyl nitrate	10	7	18	.122
Oper., centrifuging uranyl peroxide from precipitator	.16	9	15	139
Transferring H ₂ O ₂ from centrifuge bowl to boats	9	5	4	121
Oper., at east dry box while grinding ML	6	1	17	55
C-1 Wing				
Oper., evaporating U_3O_8 within dry box	2	1	20	64

⁻ continued -

¹ These results indicate the open-face hood to be inadequate in the control of air contaminants at the operation "batching E-Wing sand". Respiratory protective equipment is worn while performing this infrequent operation.

Table V (continued)

Table V (continued)	No. of	No. of Samples	Avg. Time	Avg. U-Air Conc.
Area and Description	Samples	> MPL	(Min.)	$(d/m/M^3)$
B-1 Wing				
Loading crusher ¹	7	7	6	960
Oper., at crusher while crushing 1	7	6	16	1,168
Oper., at primary columns	4	0	32	20
Oper., at secondary columns	8	.0	35	24
Oper., at calciner 1	6	6	20	381
Oper., at dissolver	7	3	23	97
Unloading material from centrifuge bowl	2	2	9	85

In an effort to reduce the above air concentrations to a satisfactory level, personnel has provided an enclosure for the crusher loading chute and increased ventilation to both the calciner and calciner hood. All persons entering these areas are required to wear respiratory protection.

Table VI
Special Processing - Breathing Zone and Operational Samples

Area and Description	No. of Samples	No. of Samples > MPL	Avg. Time (Min.)	Avg. U-Air Conc. (d/m/M ³)
UO ₂ Production ¹				
Oper., at burn box while chips are burning	2	1	22	107
Dissolving chips in HNO3	2	2	4	506
Oper., reduction and sintering	6	2	36	32
Pulverizing U3O8	3	3	3	9,446
Milling and screening U3O8	4	3	7	317
Oper., drying UO3 crystals under heat lamp	9	1	29	48
Oper., precipitating material	10	6	15	167
Oper., centrifuging material	4	4	9	703

⁻ continued -

١

Of the ten operations sampled in this area, eight show an average uranium air concentration greater than the MPL. Special consideration should be given to reducing the level of air-borne contamination at each of these eight operations. Immediate action should be taken on the "pulverizing U3O8" operation.

Table VI (continued)

Table VI (continued)							
	No. of	No. of Samples	Avg. Time	Avg. U-Air Conc.			
Area and Description	Samples	> MPL	(Min.)	(d/m/M ³)			
UO ₂ Production (cont'd.) ¹							
Transferring material from centrifuge bowl to boats	5	3	5	186			
Loading chips into chip rocket	3	3	3	245			
Room 1008							
Oper., drying chips from within dry box	6	2	12	67			
Loading and/or removing chips from dry box ²	3	3	1	1,782			
Oper., pressing chips	5	4	11	83			

Of the ten operations sampled in this area, eight show an average uranium air concentration greater than the MPL. Special consideration should be given to reducing the level of air-borne contamination at each of these eight operations. Immediate action should be taken on the "pulverizing U_3O_8 " operation.

Sample results at this operation were taken to determine the effectiveness of the increased ventilations mentioned in the February report. The above analyses show an improvement by a factor of 22 over the previous samples, however, airborne contaminants continue to remain well above the MPL.

REMOVABLE SURFACE CONTAMINATION

The results obtained from the removable surface contamination surveys indicate the degree of surface contamination in a given area and give an indication of the effectiveness of housekeeping practices. The results of the surveys taken during March, 1958, are summarized in the following table. For comparison with previous periods, reference is made to the included data and to attached graphs. The control criterion (CC) for surface contamination is 500 d/m/100cm².

Table VII

Removable Surface Contamination

	No. of	No. of Samples	Average d	$m/100$ cm 2
Area*	Samples	> CC	March	February
Line Production				
E-Wing Reduction	80	50	755	830
Dry Chemistry	100	26	501	423
E-Wing Casting	100	74	1,353	1,466
E-Wing Misc Plating, Storage and Pickling	92	57	1,156	828
D-1 Extension	32	8	376	337
Special Alloy Casting	32	24	1,328	2,073

⁻ continued -

^{*}A high percentage of the removable surface contamination surveys made in the Product Chemical uranium handling areas of Building 9212 continue to show monthly averages well above the CC. Perhaps personnel should re-emphasize the importance of good housekeeping practices and operating techniques in maintaining satisfactory smear levels.

Table VII (continued)	No. of	No. of Samples	Average d	$/m/100cm^2$
Area*	Samples	> CC	March	February
Salvage				
C-Wing	104	52	1,105	589
C-1 Wing	116	45	629	302
Head House - Rms. 26 and 29	67	39	1,157	1,551
B-1 Wing	213	93	786	
Special Processing				
E-Wing Laboratory	64	24	480	312
UO ₂ Production - Rm. 1010	36	15	919	369
Room 1008	60	30	1,106	1,429
9212 Urine Collection Station	10	2	287	217
9723-25 Lunch Room	26	0	119	_ 20

^{*}A high percentage of the removable surface contamination surveys made in the Product Chemical uranium handling areas of Building 9212 continue to show monthly averages well above the control criterion. Perhaps personnel should re-emphasize the importance of good housekeeping practices and operating techniques in maintaining satisfactory smear levels.

DIRECT RADIATION

Film badges worn by personnel in this area showed an average radiation exposure of twenty-two mrem per week per person for the thirteen-week period ending with this month. There were no exposures during the month exceeding the weekly MPL of 300 mrem.

URINA LYSES

Personnel working in uranium handling areas are requested to submit urine samples periodically. By analyzing this urine for uranium, an estimate of the internal exposure of these people is obtained. The following table gives a resume' of the cumulative uranium urinalysis results for Department 2617 personnel during the report period. The quarterly cumulative results referred to are for the 13-week period ending March 26, 1958. Attached are graphs which show the average levels for previous report periods.

Table VIII
Urine Samples

Dept.	Area	No. of Samples Analyzed	No. of Samples > 43 Mrem/Day	No. of Samples > 3900 Mrem/Qtr.	Average Mrem Per/Qtr.
2617	Salvage	287	74	13	2,534
2617-1	Foundry	85	13	1	1,544
2617-2	Special Proc.	97	12	1	1,571
2617-3	Dry Chemistry and Reduction	67	10	0	1,589
Totals		536	109	15	2,051

The following table presents the results of all persons in the department who exceeded a quarterly cumulative of 3000 mrem. Included is the confidence band, associated with each cumulative. An average confidence band at the 67% level is applied to all cumulative results below 4500 mrem per quarter and an individually calculated confidence band is applied to all levels above 4500 mrem per quarter. The MPL of exposure to internally deposited uranium is 3900 mrem per quarter. Since there is some doubt in most cases as to whether these persons are below the MPL, it is suggested that whatever steps are practicable be taken to minimize any additional exposure to airborne uranium.

The following table gives a breakdown on the participation effort of the various groups during the month.

Table X
Urinalysis Program Participation

Dept.	Area	No. of Persons Scheduled	No. of Voidings Scheduled	% of Voidings Given as Scheduled	% of Voidings Given at Other Times
2617	Salvage	104	416	93	1
2617-1	Foundry	33	132	87	0
2617-2	Special Processing	41	164	83	1
2617-3	Dry Chemistry and Reduction	29	116	70	0
Totals		207	828	87	< .1

This shows an overall participation effort of 87% which is considered satisfactory.

. D. McLendon

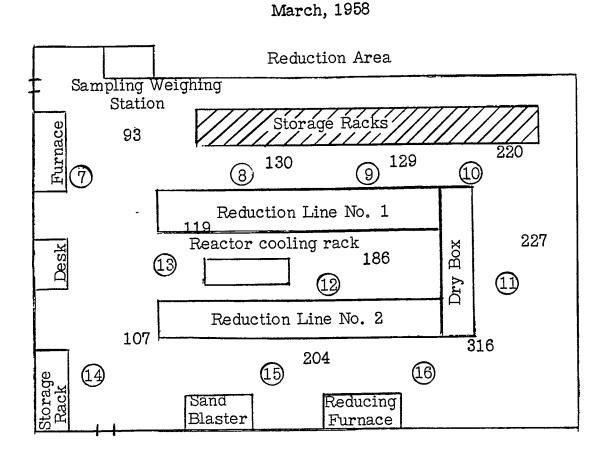
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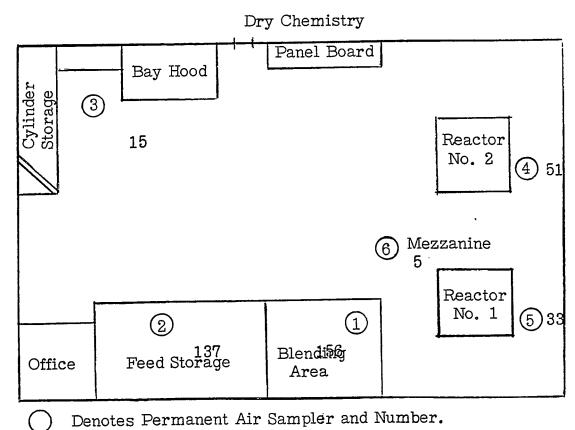
Attachments

DAY RESULTS FROM INDIVIDUAL AIR SAMPLERS - B-1 WING

Sampler Number	Sampler Location	No. of Samples		Avg. U-Air Conc. (d/m/M ³)
211-1	West end conversion room - 1st level	18	0	4
211-2	East end conversion room - 1st level	18	0	2
211-3	Control panel area - 1st level	18 [.]	0	8
211-4	Dissolving area - 1st level	18	0	10
211-5	Centrifuge area - 1st level	13	2	28
211-6	Southeast corner of 3rd level	18	2	235
211-7	Between primary and secondary columns - 3rd level	18	2	76
211-8	Center calciner room - 3rd level	18	9	236
211-9	West wall crusher room - 4th level	17	7	145
211-10	Evaporator area - 2nd level			

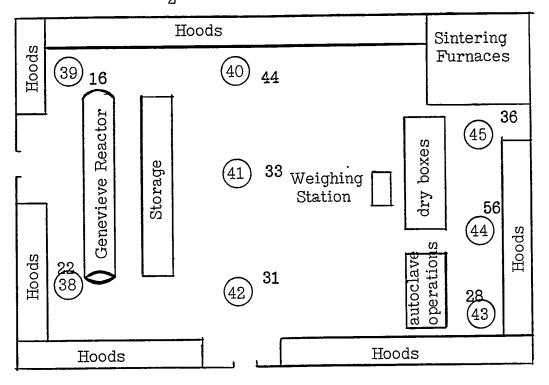
Day Averages of Uranium General Air Sampler Results ($d/m/M^3$)



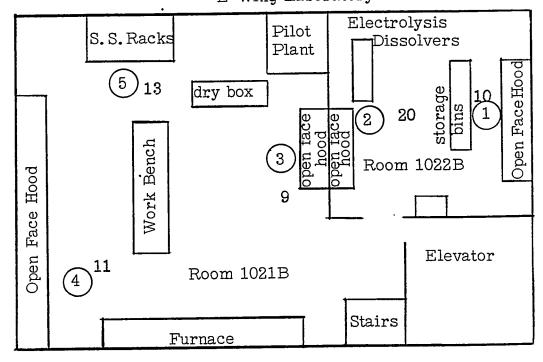


March, 1958

UO₂ Production Area - Room 1010

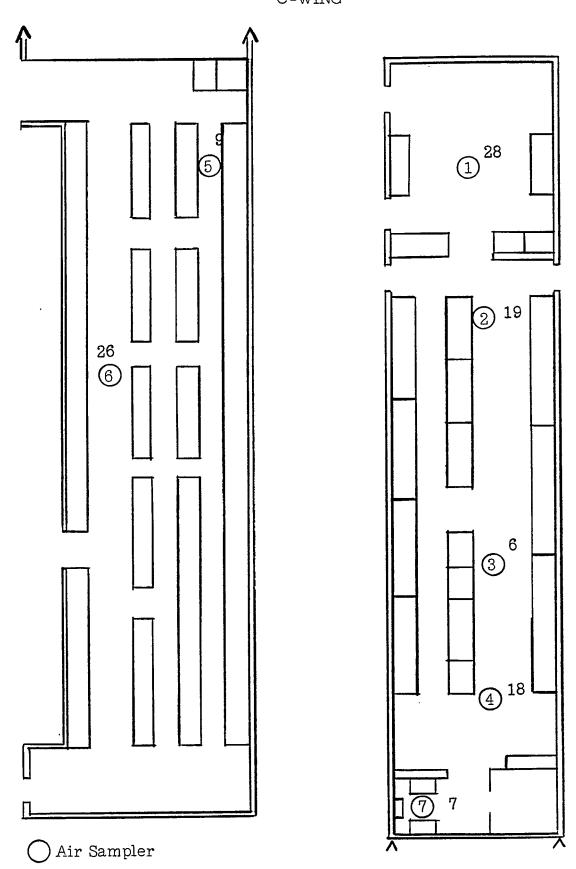


E-Wing Laboratory



O Denotes Permanent Air Sampler and Number

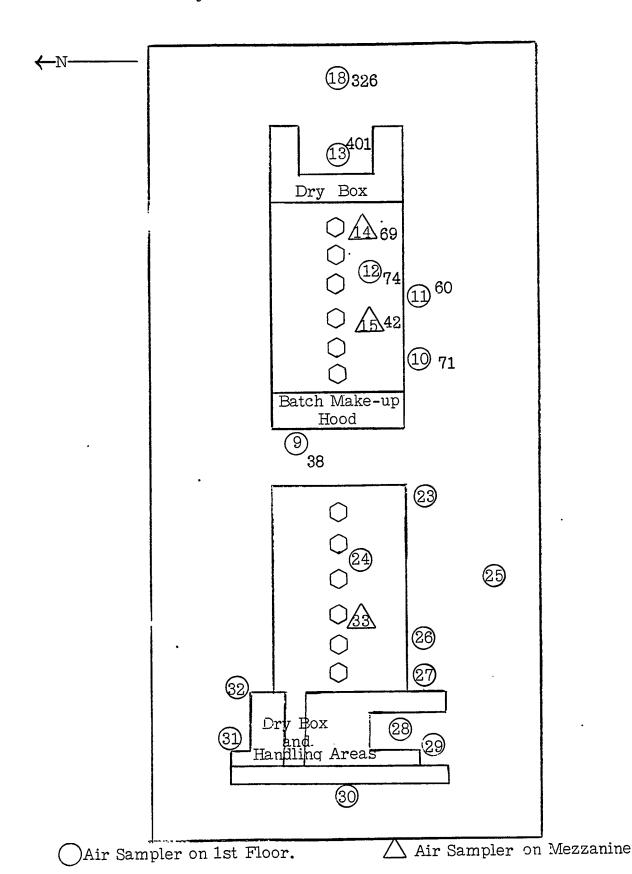
Day Averages of Uranium General Air Sampler Results $d/m/M^3$ March, 1958 C-WING



Day Averages of Uranium General Air Sampler Results (d/m/M³)

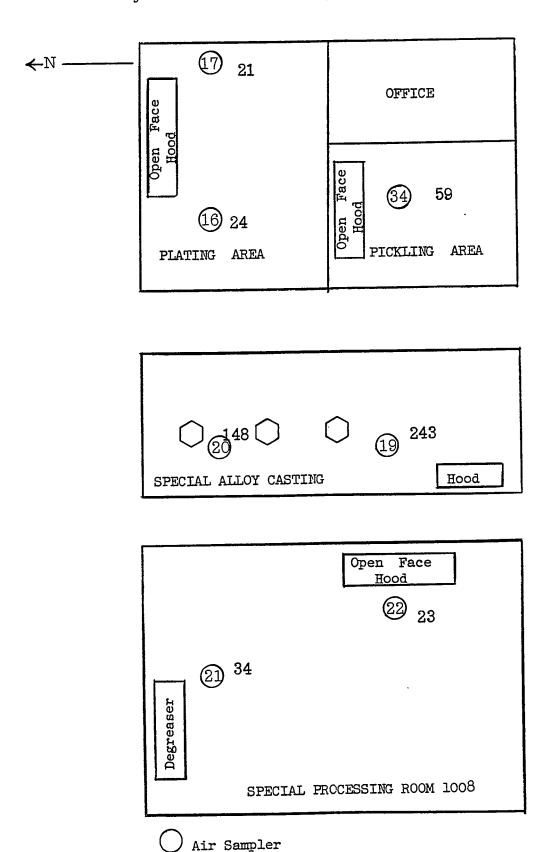
March, 1958

E-Wing Line Production - Casting Area

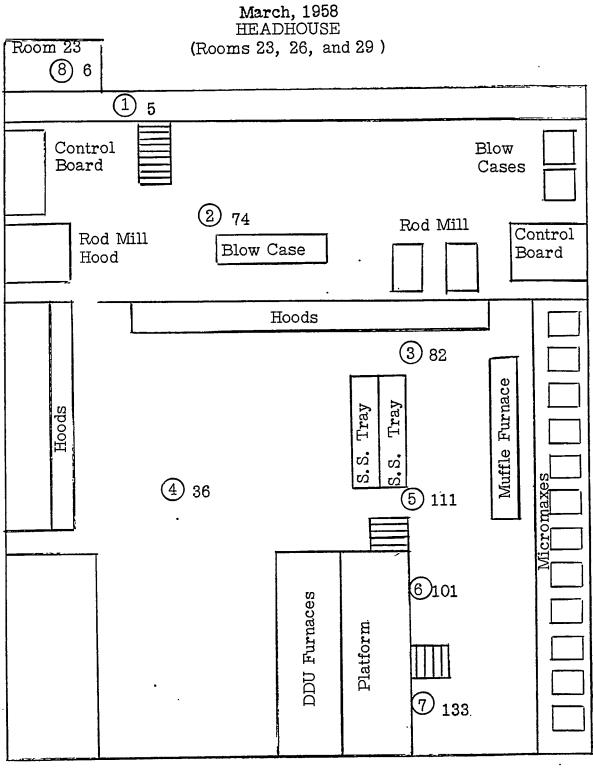


Day Averages of Uranium General Air Sampler Results $(d/m/M^3)$ March, 1958

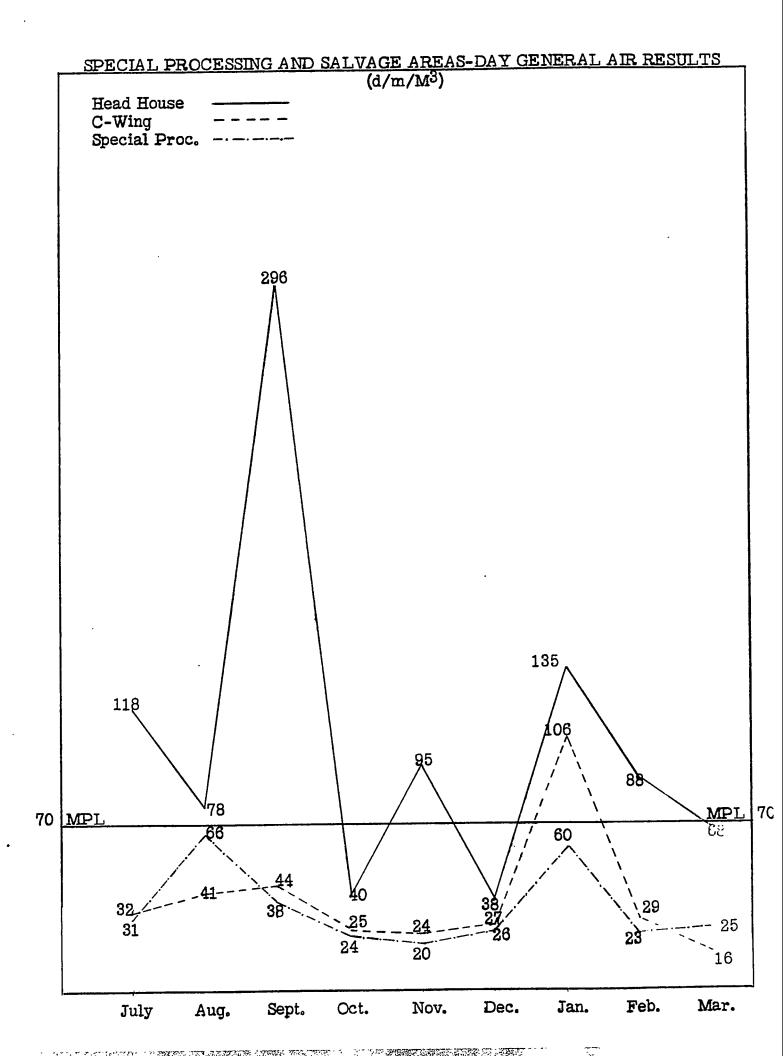
E-Wing Line Production and Special Processing Areas

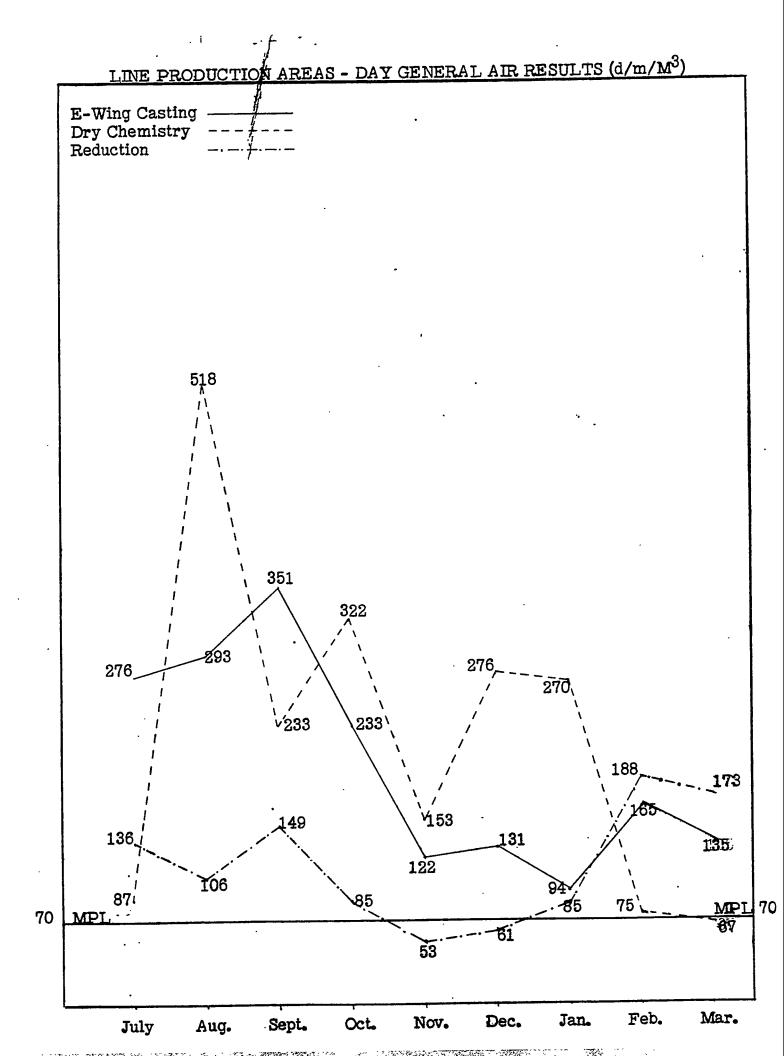


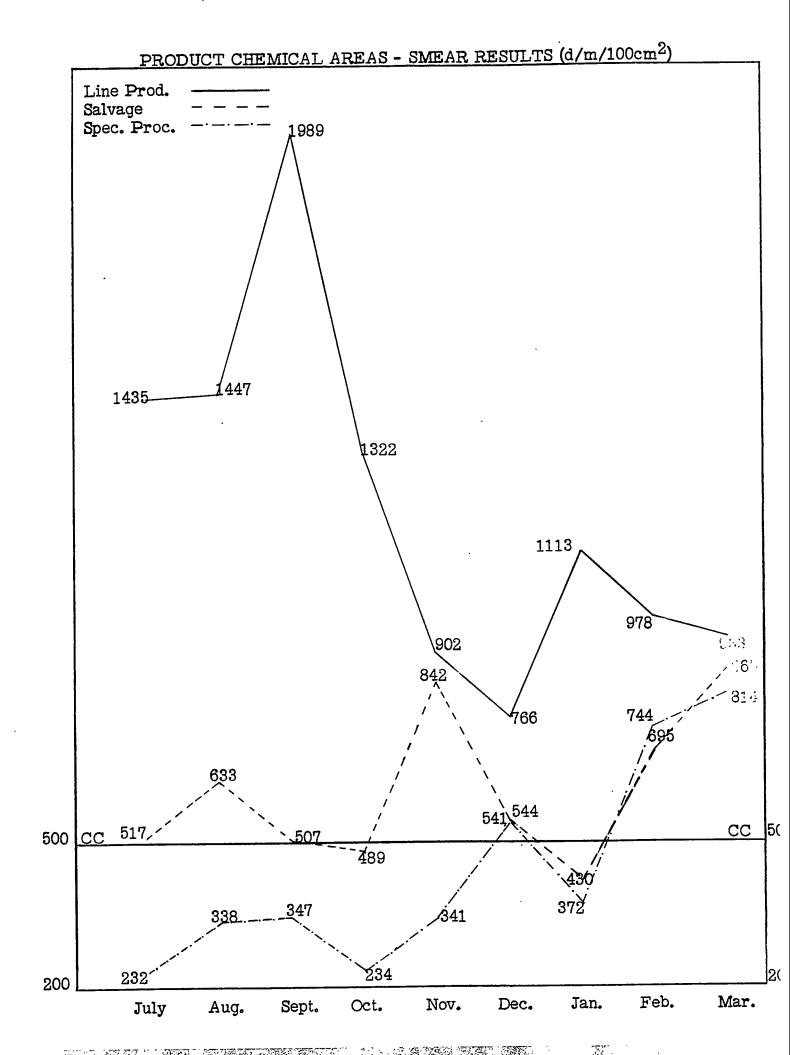
Day Averages of Uranium General Air Sampler Results (d/m/M³)

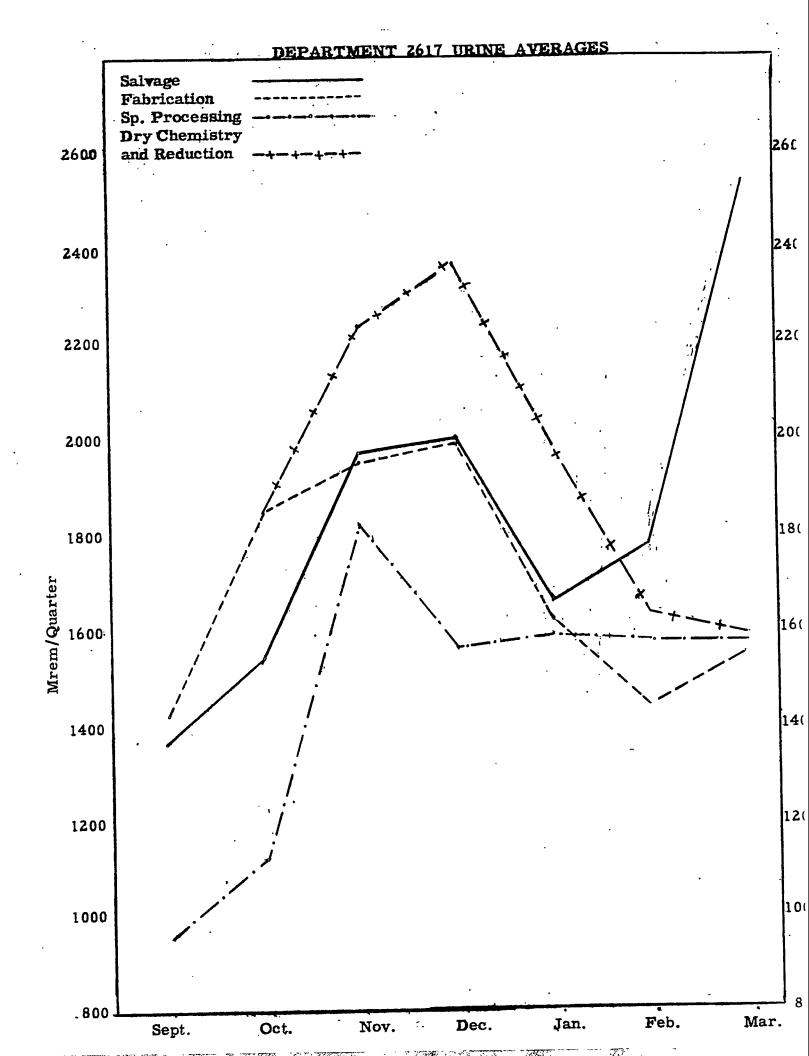


O Air Sampler









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Index No.

Subject Category: Health and

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CARBIDE AND CARBON CHEMICALS COMPANY A Division of Union Carbide and Carbon Corporation Y-12 PLANT Contract No. W-7405-eng-26

> HEALTH PHYSICS PROGRESS REPORT January 1, 1953 Through June 30, 1953

BY AUTURATION CHANGED TO 2/11 Classefield

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C&CCC 1-16 Oak Ridge, Tennessee April 15, 1954

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INTRODUCTION

New Facilities

In May, the facilities in Building 9202 were completed and all personnel and operations not already in the building were transferred. The personnel monitoring group occupied the newly equipped dosimetry area consisting of an air conditioned darkroom and an office space. The darkroom is larger and more adequately equipped than the previous one: a temperature of 68° ± 1°F is maintained in the film processing solutions by a large constant-temperature bath.

Laboratory facilities are contained in two separate units, i.e., a low-level laboratory for routine urinalysis of uranium, plutonium, and mercury; and a high-level laboratory for all samples which cannot be processed in the former unit without the possibility of contamination. Filtered air, shoe scuffs, and rigid housekeeping practices are a few additional precautions taken to insure a low contamination level. Daily air samples are taken to evaluate the adequacy of these precautions. Laboratories are provided with air-foil fume-hoods including a perchloric-acid hood in the high-level area. For analyses yielding offensive odors a hood in the low-activity laboratory is equipped with a charcoal filter.

Atomic Weapons Tests

On March 7, 1953, a representative of the Y-12 Health Physics Department was sent to the Nevada Proving Grounds Atomic Weapons Test Site to participate in the Dust and Particulate Program.

INDUSTRIAL HYGIENE SECTION

Air Sampling

Routine air sampling continued at all uranium, beryllium, and mercury handling operations. Special operations involving other contaminants were checked. A summary of results is presented in Table 1.

TABLE 1

AIR SAMPLING DATA

Contaminants	No. of General Air Samples	No. of Operational and Breathing-zone Samples	No. of General Air Samples > MPL	No. of Operational and Breathing-zone Samples > MPL
Mercury	6,514	136	1,671	21
Beryllium	458	43	0	2
Cyanide	0	4	0	0
Lead	0	5	0	0
Nitric Acid	· 20	9	0	0
Silica	. 0	10	0	10
Fluorides	0	8	0	0
Caustic Hydroxides	0	6	0	- Q
Uranium	10,940	1,266	198	451

Approximately twenty-five per cent of mercury air analyses exceeded the MPL of 0.1 mg/ M^3 because of the rapid expansion of mercury handling facilities.

Quarterly results of air analyses for uranium are presented in Table 2. With few exceptions contamination levels for this period are comparable to those of the preceding period. Breathing-zone samples taken in areas processing enriched soluble uranium show a significant decrease. Installation of localized ventilation was responsible for this reduction. Increased levels of air contamination are noted in breathing-zone samples taken in both normal insoluble, and enhanced insoluble work areas. This increase

TABLE 2
URANIUM AIR ANALYSIS

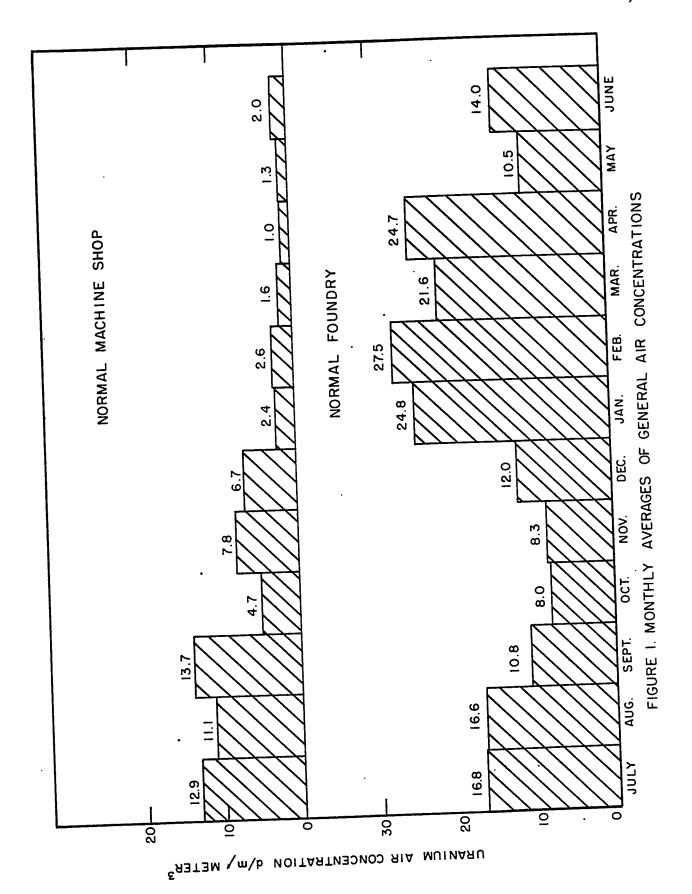
		U-Air Con d/m	tamination /M ³		
Type of Material	Area	1st Qt. 1953	2nd Qt. 1953	Туре	Respiratory Equipment
Normal Insoluble	9206-A	3,026	968	BZ*	Worn
Normal Insoluble	9206-A	22	24	BZ	Not worn
Normal Insoluble	9206-A	70	56	GA XX	Not worn
Normal Insoluble	9212-B	443	3,478	BZ	Worn
Nor mal Insoluble	9212-B	60	54	BZ	Not worn
Normal Insoluble	9212-B	9	8	GA	Not worr
Enriched Soluble	9212-B	681		BZ	Worn
Enriched Soluble	9212-B	246	29	BZ	Not wor
Enriched Soluble	9212-B	4	3	GA	Not wor
Enriched Insoluble	9212-B	3,783	1,175	BZ	Worn
Enriched Insoluble	9212-B	78	69	BZ	Not wor
Enriched Insoluble	9212-B	13	13	GA	Not wor

^{*}BZ - Breathing-zone samples.

was due to fires and to ventilation failures. In all three of the above areas respiratory protective equipment was used. Monthly averages of the levels recorded by permanent air samplers in production areas are shown in Figures 1 and 2. Completion of hoods and modification of process methods resulted in a reduction of general air contamination in the normal uranium machine shop. Elevated air concentration in the normal foundry resulted from production changes and ventilation failures. Improved hooding and operating procedures were responsible for the May-June decline in air contamination in this area. The rise in air contamination, as revealed by the general air results in the enhanced chemistry and foundry areas, was correlative with production increases and relaxation of operating techniques.

Figures 3 and 4 illustrate the lowering of air contamination in two normal uranium handling areas during the last two and one-half years.

^{**}GA - General air samples.



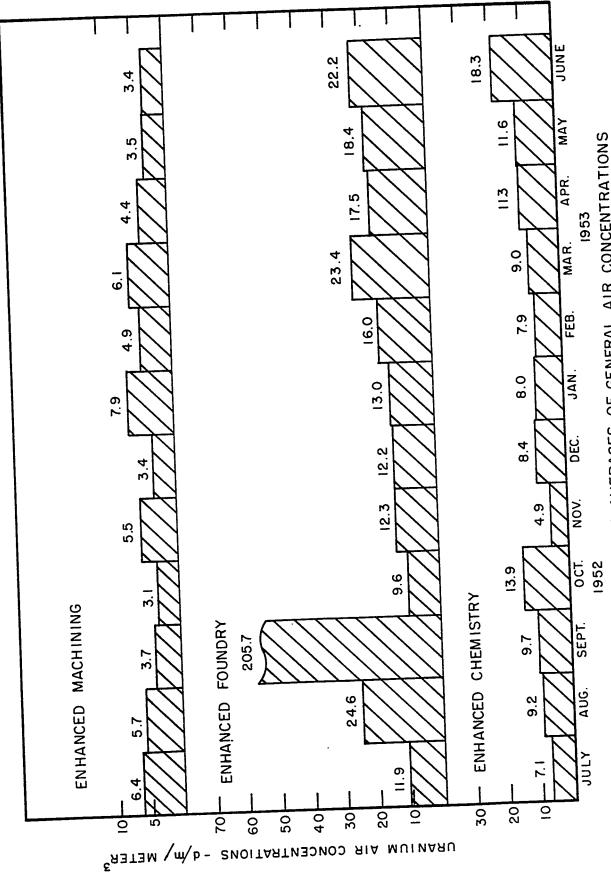
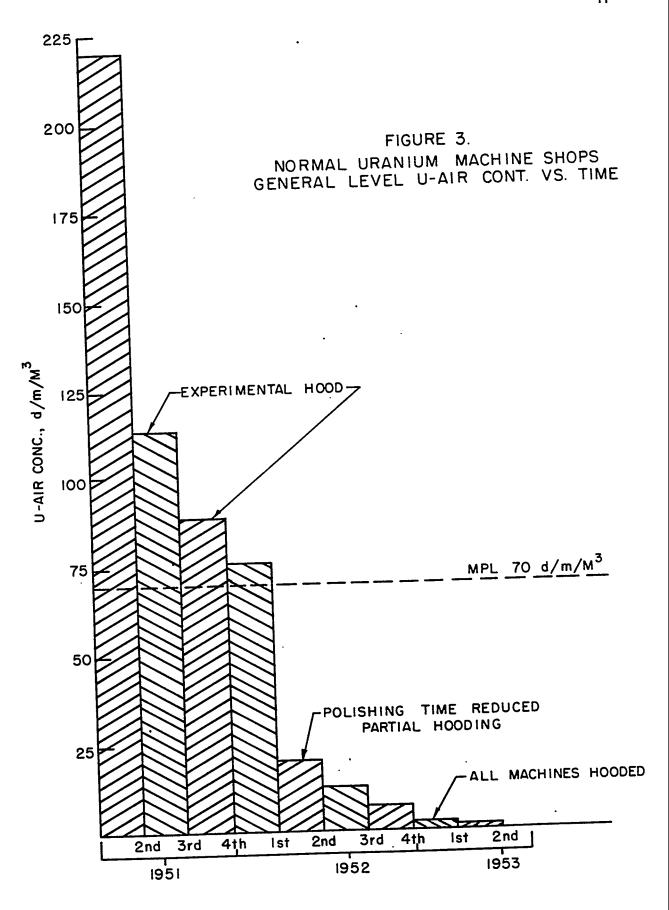
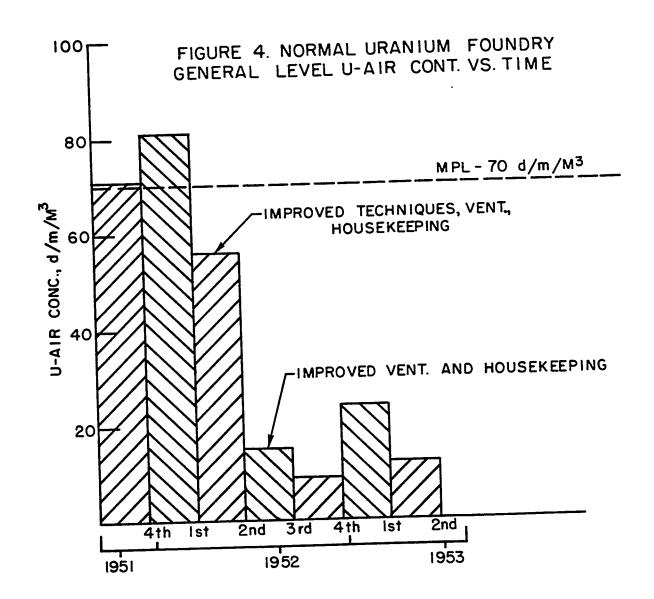


FIGURE 2. MONTHLY AVERAGES OF GENERAL AIR CONCENTRATIONS





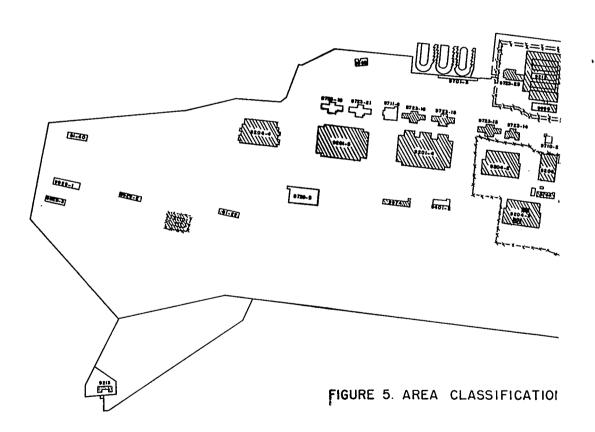
CONTAMINATION CONTROL SECTION

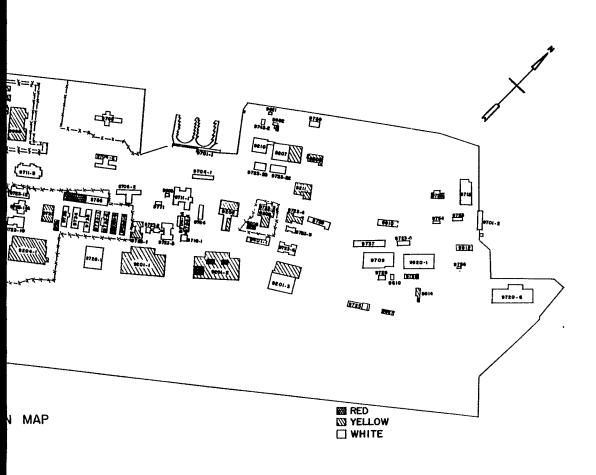
Surface contamination surveys are made of operational areas and standby buildings to determine the level of radioactive contamination. Surveys are of two types: (1) direct readings using a standard alpha survey meter, and (2) smear samples each taken from approximately 100 cm² of surface. Summary of the data from each area is reported to responsible supervision.

Transferable contamination as determined by smear sampling is classed as follows: (1) floors, which indicate the spread of contamination by traffic from one area to another, (2) settled dust, which is an index to the presence of air-borne material, and (3) working surfaces, which may be suggestive of poor housekeeping or careless operational practices.

Buildings or areas within buildings are classified as Red, Yellow, or White based upon the contamination present. Redareas are those in which the materials handled are toxic, or the level of radioactive contamination is so high that a shower is required of all employees at the end of the work shift. A Yellow area is one in which nuisance contamination levels are encountered. Areas not classed Red or Yellow are considered to be free of contamination and are classed as White. Figure 5 shows the classification of areas as determined by contamination surveys. In an effort to control the spread of contamination from high-level areas to low-level areas, surveys are made of all equipment leaving a high-level area; all personnel working in such areas are provided with protective clothing.

To ascertain that shipments of materials or equipment leaving the Y-12 Area by common carrier comply with regulations of the Interstate Commerce Commission, contamination and/or radiation inspections are made of all such shipments. Information regarding results of these surveys accompanies the shipping invoice.





RADIOLOGICAL SECTION

Routine Monitoring

A total of 379 persons were regularly issued one or more film meters. Table 3 is a summary of film processed.

TABLE 3
FILM PROCESSED FOR THE FIRST HALF OF 1953

Type of Meter	•	Number Worn
Regular Issued Badges		7,436
Regular Issued Rings (including finger pads)		5,932
Visitor Badges (for special monitoring pu	rposes)	975
Neutron Film Badges		420
	TOTAL	24,853

Building 9213

The Health Physics Department assisted in gamma-ray distribution studies of a moderate critical assembly. Dental film packs were exposed at various distances from the center of the reactor operating at zero power level.

Arco Salvage

Radiation hazards in connection with the recovery of uranium from Arco salvage material were investigated. Sampling indicated that forty-three per cent of the active material (Ru¹⁰⁶) was carried away as waste, three per cent remained in the cycle, and fifty-four per cent accompanied the product material. The project is still in operation and necessary recommendations will continue to be made in an effort to eliminate possible hazards.

Biology Division

A Cockcroft-Walton linear accelerator capable of producing a maximum of 10^{10} neutrons per second has been temporarily installed in an unused section of Building 9207. Proper shielding will be provided by permanent location which is now under construction. Neutron track film used by personnel working with the accelerator have indicated no significant exposures.

RaLa Particle Size Program

As a part of the program to evaluate particle size in exhaust and ventilation gases associated with a RaLa run, the Health Physics Department undertook air sample counting. Absorption and gamma-scintillation spectrometer curves were made daily of samples which were sufficiently active.

Early in the program it was evident that a gamma spectrometer and beta-gamma counters would have to be continuously available. In view of such needs these facilities have been installed. Figure 6 shows the new G. M. beta-gamma instruments which utilize glow-transfer counters. Figure 7 indicates the arrangement of the gamma scintillation spectrometer showing power supply, linear amplifier, glow-transfer counter, pulse-height selector, count-rate meter, and lead shield containing the scintillation unit.

Personnel Exposure Study in the 9212 B-1 Foundry

High levels of activity associated with castings produced radiation problems in the foundry. Each person wore a film badge and a finger pad, and some, depending on their job assignment, wore as many as four badges simultaneously in an effort to determine what portion of the body received the greatest exposure.

Castings were monitored as they came from the molds. The intensity of radiation from castings depends upon the type of charge material used. When castings were made from scrap and/or briquettes, personnel exposures were at a minimum; old overflow materials caused an increase in exposure. Because extensive accumulation of active daughter products within the rods came to the surface of parts during casting, the greatest radiation problem was created when long-stored rods were used. Surface readings as high as 25 rep/hr were detected on some parts containing rod material. (Further explanation of the above phenomenon has been previously explained in another report.)

¹Collier, R. M., 'The Surface Concentration of Radioactivity in the Casting of Natural Uranium,' C & CCC, Y-12 Plant, to be published (Y-1025).

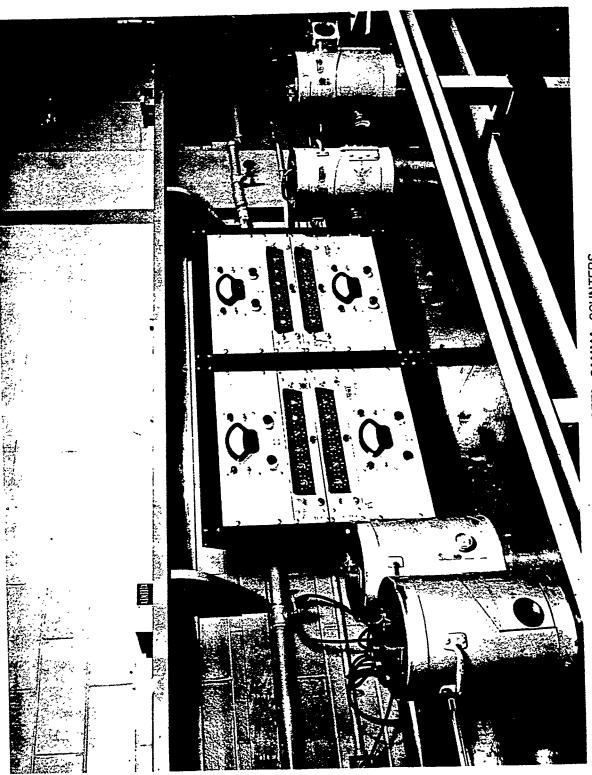


FIGURE 6. BETA GAMMA COUNTERS



FIGURE 7. GAMMA SCINTILLATION SPECTROMETER

Five different operations in the foundry were analyzed and are listed below.

Dismantling

This operation involves the removal of the hard graphite core around which the part is cast. The operator works in close proximity to the casting.

Crucible Burning

After the charge leaves the crucible and flows into the mold some residual material (scull) remains. This material must be burned out before the crucible can be reused. Sculls contain a considerable amount of the active material which contributes greatly to exposures.

Furnace Operation

This involves loading and unloading the furnaces.

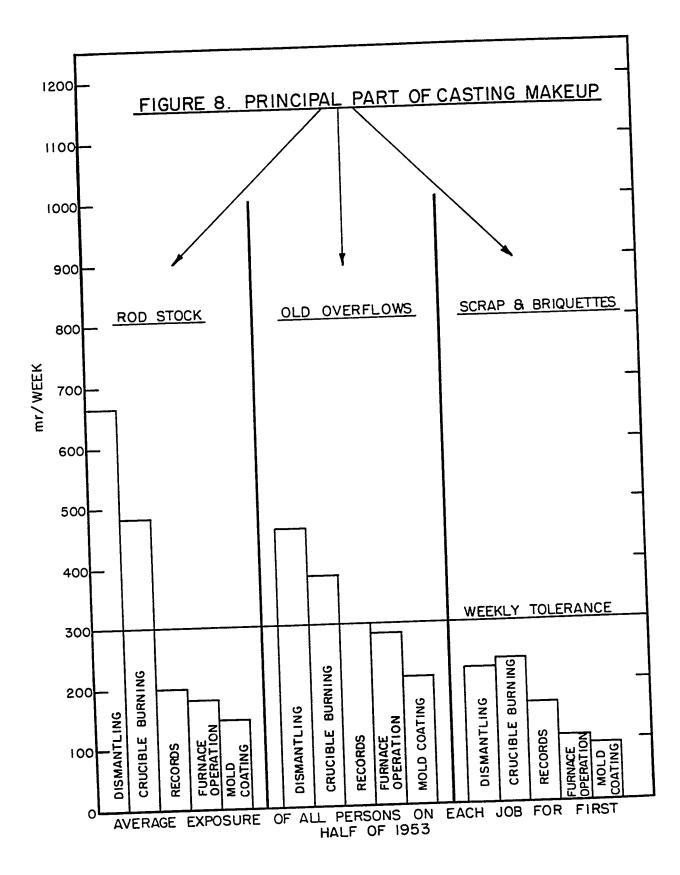
Record Keeping

This involves making up and weighing charges and recording make-up and weights of castings.

Mold Coating

This involves cleaning and coating the mold in preparation for the new casting.

Figure 8 is a presentation of the average weekly exposure received on these jobs for the first half of 1953. Also indicated is the type of material used and its apparent influence on exposures. Figure 9 is a comparison of weekly finger pad and badge exposures for the first 26 weeks of 1953.



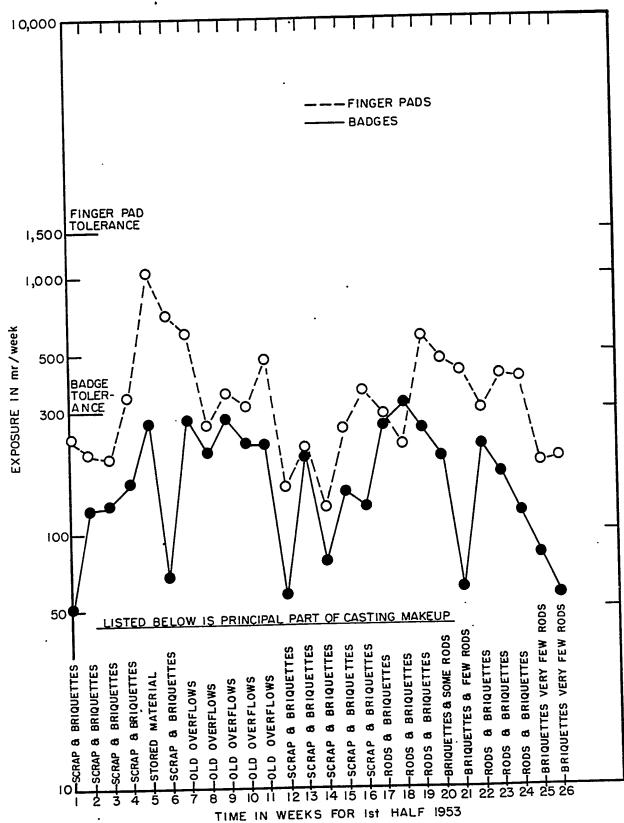


FIGURE 9. EACH POINT IS THE AVERAGE WEEKLY EXPOSURE OF FOUNDRY PERSONNEL

ANALYTICAL SECTION

Routine Analysis

During this period a total of 8,750 uranium analyses were made: 5,274 by the electroplating method, and 3,476 by the fluorometric method. Figures 10 and 11 indicate the distribution of the urinary uranium concentrations.

New Electroplating Equipment

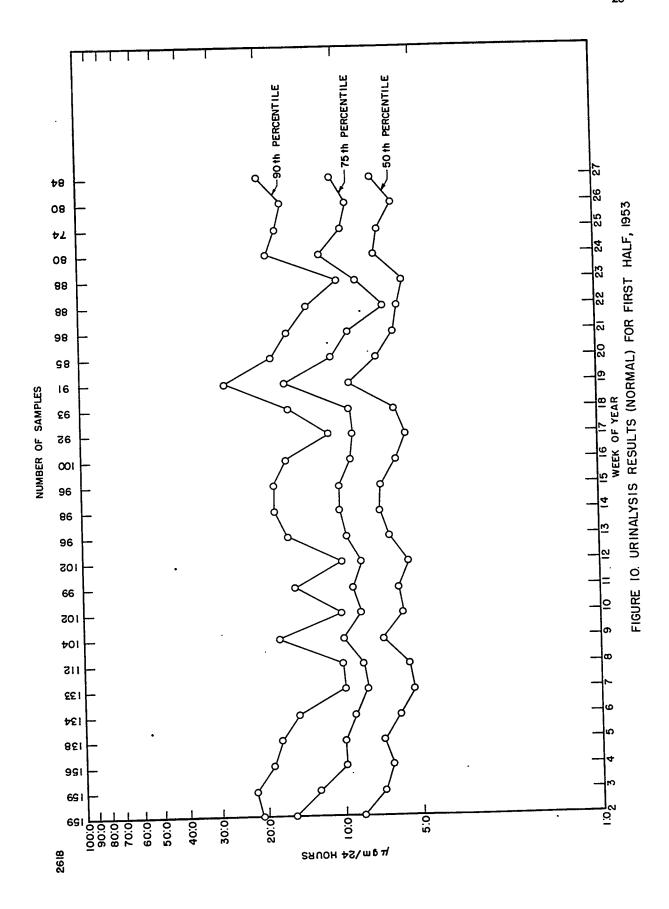
An abstract of a report covering the design of new electroplating equipment follows:

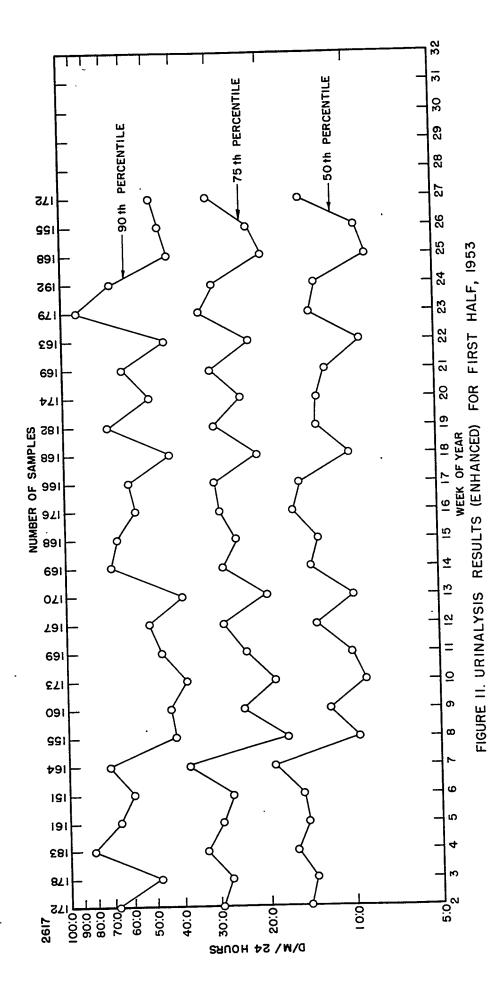
A simplified procedure has been developed for analyzing micro-quantities of enhanced uranium in urine, with a primary interest in its applicability to routine monitoring of personnel for internal exposures. The method consists basically of electrodepositing uranium on a cathode and measuring alpha activity.

Urine samples are partially digested with nitric acid. Residue from the digestion is added to a solution of ammonium oxalate and ferric-ammonium sulphate. Uranium and iron are codeposited, probably as hydroxides, when the resulting solution is electrolyzed in a plating cell.

A simplified power supply and a plating cell assembly have been developed in which no auxiliary temperature control is required. Good circulation of the electrolyte is accomplished by gas evolution from the electrodes in a slightly tilted cell.

Recoveries from a group of 54 randomly selected routine urine samples, to which 0.1 microgram of enhanced uranium was added, had a mean value of 85.5 per cent with a standard deviation of 10.1 per cent.





SPECIAL STUDIES

Internal Radiation

Work has continued on analysis of uranium excretion curves of twentyone employees referred to in a previous report. An average decay curve of uranium excretion per day has been calculated from elementary considerations of data as established by the following procedures:

- l. Results from urine samples voided during the first week were averaged. This average is termed the initial excretion level, or $N_{\rm o}.\,$
- 2. Results of analyses of urine samples voided in the periods 7-14, 14-21, 21-28, 28-56 days, etc., were also averaged. This average is termed the excretion level at the time t, or $N_t\,.\,$ The interval was increased from 7 to 28 days in order to improve the statistics.
- 3. The logarithm of N_{o}/N_{t} divided by tyields the decay constant $\lambda.$

$$\lambda = \ln(N_o/N_t) \div t$$

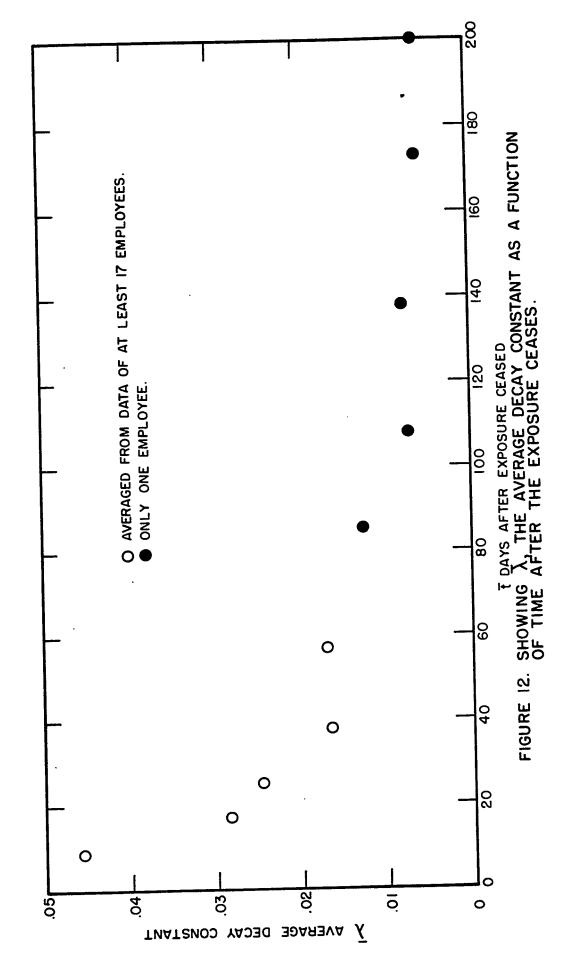
4. An average decay constant $\overline{\lambda}$ was calculated from the data by the equation

$$\overline{\lambda} = \Sigma (\lambda/n) = \ln(N_0/N_t) \div n\overline{t}$$

where n = number of employees who contributed urine samples and \overline{t} is the effective time at which the samples were submitted for analysis.

A plot of $\overline{\lambda}$ versus \overline{t} is shown in Figure 12. The solid points on this graph are the λ 's calculated from data of one of the twenty-one employees whose exposures had ceased 90 days prior to his removal from Building 9212. The data suggests a hyperbola which when plotted on log-log paper yields a linear relationship (Figure 13). By means of least-squares curve fitting technique the data may be approximated; the best equation representing this is

$$\ln \overline{\lambda} = \ln(.247) - .74 \ln \overline{t}$$
.



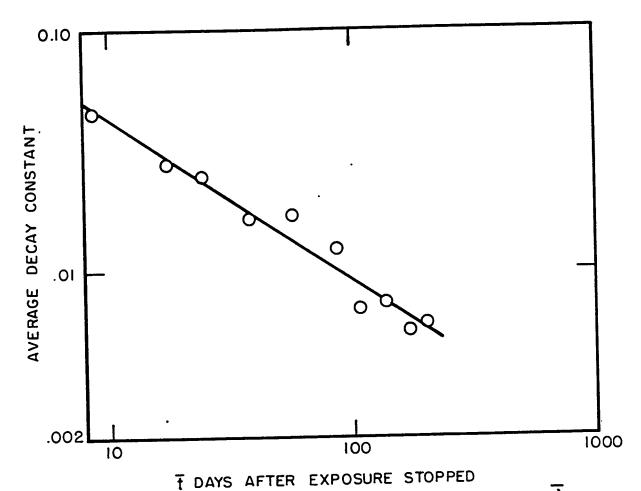


FIGURE 13. LINEAR RELATIONSHIP SHOWN BY $\bar{\lambda}$, THE AVERAGE DECAY CONSTANT AS A FUNCTION OF TIME AFTER EXPOSURE CEASES AND THE "BEST FITTING"EQUATION. LOG $\bar{\lambda}$ = LOG (0.247) - .74 LOG (\bar{t})

This equation can be used for the purpose of calculating an average decay curve since $\overline{\lambda}$ can be determined for various values of \overline{t} and inserted into the simple exponential equation

$$N_t = N_0 e^{-\lambda t}$$
.

A graph of the average decay curve (solid line) is shown in Figure 14. From this figure we note that:

- 1. The excretion level reaches approximately one-half of the initial level in two weeks following the cessation of exposure.
 - 2. After the two weeks period the decrease is slight.

These findings have instigated a study of the kinetics of excretion of uranium. A Model of the distribution and excretion following inhalation of uranium was designed, and approximate equations were derived from the Model which is indicated in Figure 15. These linear differential equations are:

Lung
$$dL/dt = \lambda_e L,$$

$$Blood \qquad dB/dt = \lambda_e L + \lambda_o O - \lambda_b B = 0,$$

$$Bone \qquad dO/dt = f \lambda_b B - \lambda_o O,$$

$$Kidney \qquad dK/dt = (1-f)\lambda_b B - \lambda_k K,$$

$$Urine \qquad dU/dt = \lambda_k K,$$

where L, B, O, K, and U are the amounts of uranium in lung, blood, bone, kidney, and urine respectively. The λ 's are the biological decay constants of these organs; f is the fraction going from blood to bone.

Assuming the organs contain equilibrated amounts at the cessation of exposure and the rate of change in the blood is always constant, the expression for excretion by way of urine is:

$$\begin{split} \mathrm{d} u/\mathrm{d} t &= \frac{\lambda_k (1-f)\lambda_e L_o}{\lambda_o (1-f) - \lambda_e} \left\{ \frac{(\lambda_o - \lambda_e)}{(\lambda_k - \lambda_e)} \, \epsilon^{-\lambda_e t} - \frac{f \lambda_e \epsilon^{-(1-f)\lambda_o t}}{(1-f)[\lambda_k - (1-f)\lambda_o]} \right. \\ &+ \left. \frac{\lambda_e (\lambda_o - \lambda_k) \left[\lambda_o (1-f) - \lambda_e \right]}{\lambda_k (\lambda_k - \lambda_e) \left[\lambda_k - (1-f)\lambda_o \right]} \, \epsilon^{-\lambda_k t} \right\}, \end{split}$$

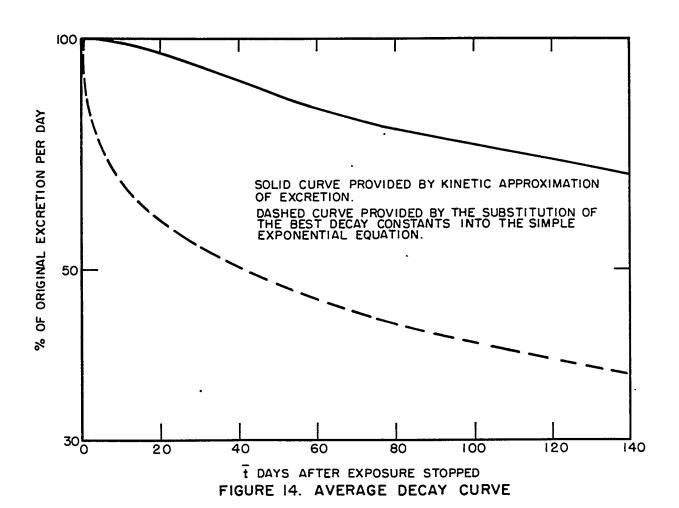
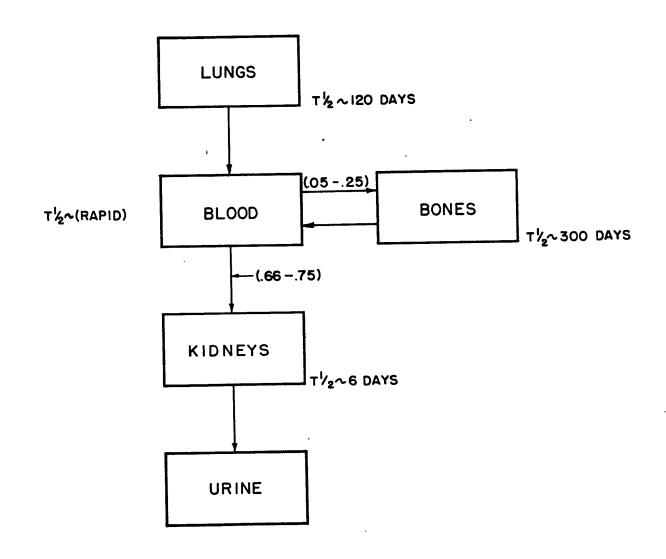


FIGURE 15. A MODEL OF THE DISTRIBUTION AND EXCRETION FOLLOWING INHALATION OF URANIUM



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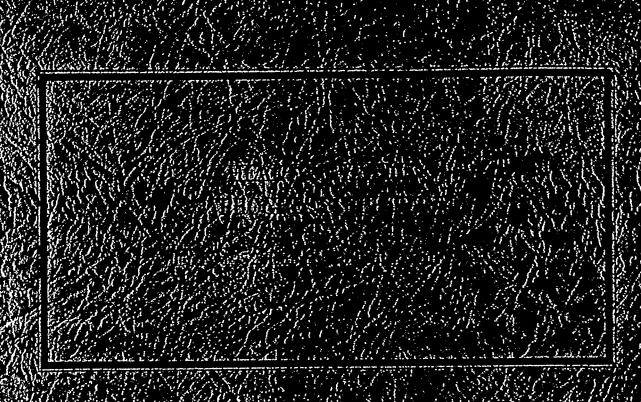
where dU/dt is the amount excreted per unit time and L_{o} is the amount of uranium in the lungs at the time the exposure ceased.

The values of decay constants λ and fractions f, which have been determined from studies of small animals, when substituted into the above equation, yielded the dashed curve in Figure 14. This curve does not agree with experimental findings. Reasons for the lack of agreement are not known, but it may be surmised that retention of uranium in humans is different from that in small animals. This is important from the standpoint of internal radiation delivered to various organs by stored uranium.

At present a kinetic study is being applied to excretion data on humans who were injected with uranyl nitrate hexahydrate. Since the excretion is not due to elimination of uranium stored in the lung, the lung may be eliminated from the Model.

Bassett, Samuel H., et al., 'The Excretion of Hexavalent Uranium Following Intraveneous Administration. II Human Studies, 'University of Rochester, June 25, 1948 (UR-37).





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HEALTH PHYSICS PROGRESS REPORT

July 1, 1952 through December 31, 1952

E. G. Struxness, Department Superintendent

Oak Ridge, Tennessee February 8, 1954

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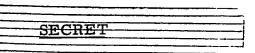


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INTRODUCTION

This report covers the activities of the Health Physics Department during the second half of 1952. Besides routine operations involving radiological and industrial hygiene monitoring of air-borne contamination, direct readings of radioactive materials, and personnel protection monitoring; work was continued on the long range study of effects of low-level continuous uranium exposure. Details and results of studies initiated during the first half of 1952 on 21 workers who were removed from further uranium exposure are presented.

New Facilities

Remodeling operations of building 9202 for the Health Physics Department have progressed but not as rapidly as originally planned. Dismantling operations are complete, and new partitions have been installed. The radioactive particle counting laboratory has been moved from 9706-2 to new quarters in 9202. The completion date has been set tentatively for May 1, 1953.

Orientation and Training

Training activities are the same as described in an earlier report (Y-858), including weekly orientation talks given to new employees, and one week of training given to AEC Fellows in Radiological Physics.





INDUSTRIAL HYGIENE SECTION

Air Sampling

Routine air sampling continued at all uranium, beryllium, and mercury handling operations. Analyses for other air contaminants were made whenever conditions warranted.

Air analyses for mercury indicated a trend toward higher concentrations which resulted from the rapid expansion of the mercury handling facilities and the lag in the installation of ventilation equipment and in the development of good housekeeping practices. A large percentage of mercury samples which were above the MPL were obtained in the research and development areas; production areas are under relatively good control.

Effective control measures in areas handling beryllium and its compounds continued. A summary of the data from air contaminants is presented in Table 1.

TABLE 1

AIR SAMPLING DATA

Contaminant	No. of General Air Samples	No. of Operational and Breathing Zone Samples	No. of General Air Samples Exceeding MPL	No. of Operational and BZ Samples Exceeding MPL
	000	125	n	0
Beryllium	906	125	0	0
Carbon Monoxide	10	0	U	0
Hydrogen	0	5	0	0
Lead	10	2	0	0
	4612	288	1416	96
Mercury	6	0	0	0
Zirconium	_	•	0	0
Hydrogen Fluoride	8	0	U	•
Uranium	9388	3730	116	741

Quarterly results of air analyses for uranium are presented in Tables 2 and 3. Most of the contamination levels shown in these tables are lower than comparable ones for the previous report period. A notable exception is the result of the breathing-zone samples taken at the operation handling enriched, soluble material, where respiratory protective equipment was



TABLE 2

URANIUM AIR ANALYSIS - 3RD QUARTER 1952

Type of Material	Area	Number of Samples	Avg. Time (Minutes)	U Air Conc. d/m/M ³	Type*	Protective Respiratory Equipment
Normal-Insoluble	9206-A	145	12.5	5860	BZ	Worn
Normal-Insoluble	9206-A	51	32.4	44	BZ	Not Worn
Normal-Insoluble	9206-A	137	109.0	68	GA	Not Worn
Normal-Insoluble	9212-B	127	10.0	272	BZ	Worn
Normal-Insoluble	9212-B	114	12.0	109	BZ	Not Worn
Normal-Insoluble	9212-B	2309	281.0	59	GA	Not Worn
Enriched-Soluble	9212-B	10	8.0	· 4418	BZ	Worn
Enriched-Soluble	9212-B	153	10.1	1040	BZ	Not Worn
Enriched-Soluble	9212-B	415	582 . 0	11	GA	Not Worn
Enriched-Insoluble	9212 -B	155	28.0	200	BZ	Worn
Enriched-Insoluble	9212-B	906	19.0	113	BZ	Not Worn
Enriched-Insoluble	9212-B	2336	473.0	47	GA	Not Worn

^{*}BZ - Breathing Zone

TABLE 3

URANIUM AIR ANALYSIS - 4TH QUARTER 1952

Type of Material	Area	Number of Samples	Avg. Time (Minutes)	U Air Conc. d/m/M ³	Туре*	Protective Respiratory Equipment
				1.50	D.7	Worn
Normal-Insoluble	9206-A	67	11	1456	BZ	
Normal-Insoluble	9206-A	8	19	76	BZ	Not Worn
Normal-Insoluble	9206-A	25	86	15	GA	Not Worn
Normal-Insoluble	9212-B	32	7	239	BZ	Worn
Normal-Insoluble	9212-B	60	13	52	BZ	Not Worn
Normal-Insoluble	9212-B	2210	395	7	GA	Not Worn
Enriched-Soluble	9212-B	12	6	3766	BZ	Worn
Enriched-Soluble	9212-B	85	21	42	BZ	Not Worn
Enriched-Soluble	9212-B	306	402	8	GA	Not Worn
Enriched-Insoluble	9212-B	49	55	383	BZ	Worn
Enriched-Insoluble	9212-B	125	17	44	BZ	Not Worn
Enriched-Insoluble	9212-B	3140	390	8	GA	Not Worn

^{*}BZ - Breathing Zone

GA - General Air

GA - General Air

used. Improved ventilation installed at this operation during the last quarter of 1952 can be expected to reduce the contamination levels. Another exception to the downward trend is shown by the results obtained during the third quarter at the operations where soluble, enriched uranium is handled without respiratory protection. Ventilation difficulties were responsible for the high levels.

Permanent air samplers installed in five sections in the uranium production areas are operated approximately seven hours per day. The general level of air contamination obtained from the average of results in each area provides a reliable index in the trend of air concentrations. The monthly average contamination level in each section as shown in Figures 1 and 2 indicates a downward trend of the air contamination in both normal and enhanced uranium operations. With one exception the enhanced foundry and the machine shop show consistently low levels of uranium contamination. The abnormally high air average in September in the foundry resulted from a uranium metal fire.

Chip Traps

Normal area machine hoods are supplemented by air cleaning equipment composed of two separate units: (1) primary collectors which remove large particles and chips, and (2) a central filter for effluent air.

Two small high speed lathes, one fitted with a newly designed chip trap, were utilized in a comparative study determining the effectiveness of the trap. The trap, which employs an abrupt change in the direction of flow as the trapping mechanism, is shown diagrammatically in Figure 3. Isokinetic air sampling equipment was used in the branch duct from the hood of each lathe to obtain a representative sample of the air stream. The test results are summarized below:

- 1. When sampling, large chip clusters were found on the probe tube inserted in the duct with no trap.
- 2. The weight efficiency for the trap was approximately 60 percent.
- 3. The trap collected slightly in excess of 200 grams of uranium in less than a month of operation.
- 4. An appreciable quantity of coolant mist was collected in the trap and discharged into the coolant supply.
- 5. At an air flow of 400 cfm, the trap has a pressure drop of two inches of water.
- 6. Relative ease of trap cleaning permits routine uranium inventory.

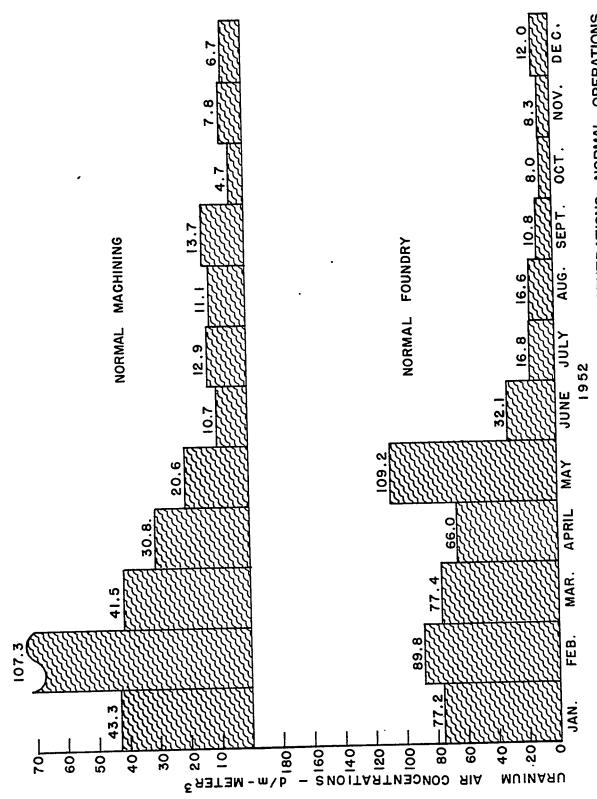
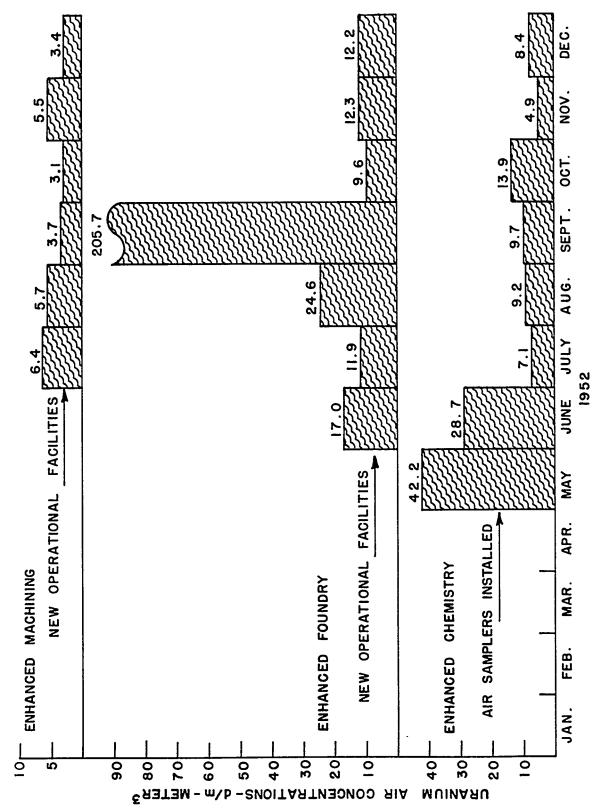
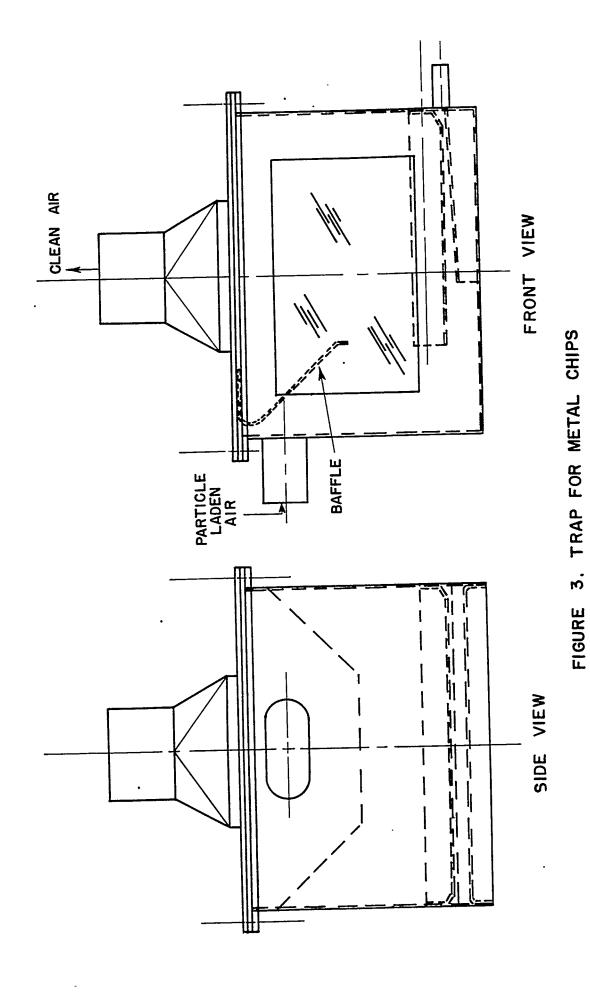


FIGURE I. MONTHLY AVERAGES OF GENERAL AIR CONCENTRATIONS - NORMAL OPERATIONS



CONCENTRATIONS - ENHANCED OPERATIONS GENERAL AIR MONTHLY AVERAGES OF તું FIGURE



Hood Installation

Hoods of standardized design, ¹ for machine operations on normal uranium, installed on most of the machines during the latter part of the fourth quarter should reflect a diminution in the air levels associated with these operations. New hoods with improved ventilation are being installed in the enhanced foundry area.

Struxness, E. G., "Health Physics Progress Report, January 1, 1952 to July 1, 1952," C&CCC, Y-12 Plant, February 19, 1953 (Y-940) p. 11.

RADIOLOGICAL MONITORING

Personnel Monitoring

Routine monitoring of individuals continued during this period. Table 4 indicates type and number of personnel meters used.

TABLE 4
FILM PROCESSED THE LAST HALF OF 1952

Type of Meter	Number Worn
Regularly Issued Badges	7,930
Regularly Issued Rings and Pads	6,320
Visitor Badges	9,074
Neutron Film	455
TOTAL	23,779

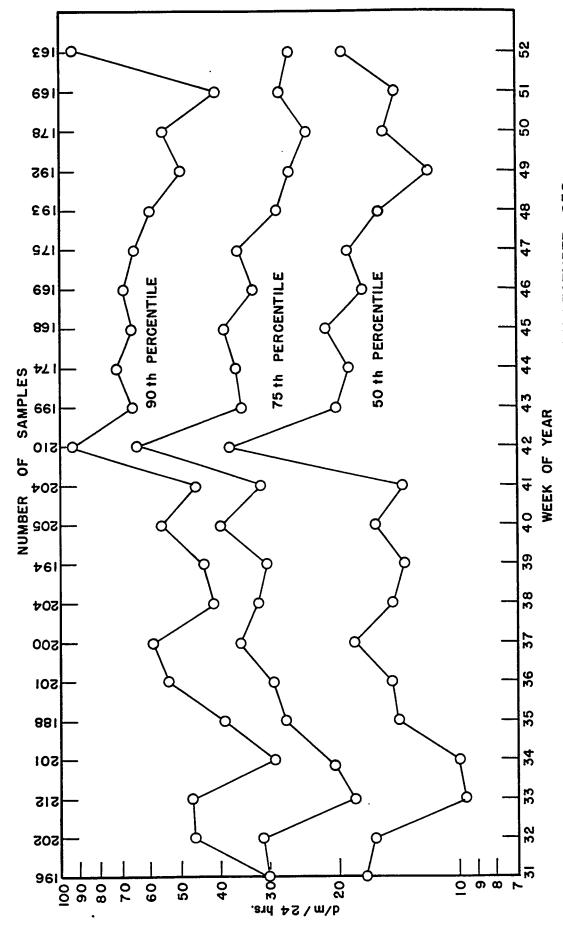
A total of 557 persons regularly wore one or more of the monitoring devices mentioned above.

A total of 10,358 urine analyses, 4,197 electroplated (enriched uranium) and 6,161 fluorometric (normal uranium) was performed. Figures 4 and 5 indicate the distribution of the urine concentrations for enriched (Department 2617) and normal (Department 2618), respectively. No correlation between air sample data and the fluctuations of these graphic values can be found.

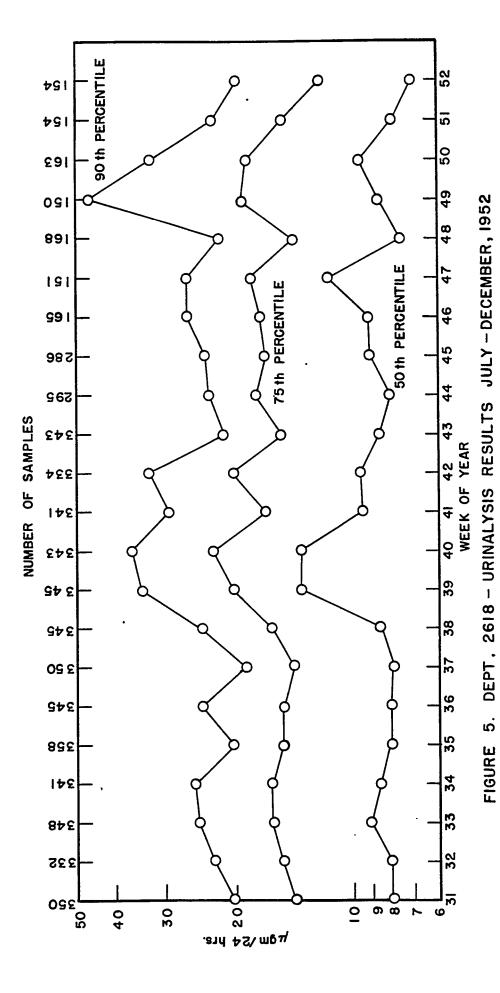
86-Inch Cyclotron

Routine cyclotron operation has continued during this period with no unusual exposure events having been recorded. Beam deflection is expected to become a reality in the latter part of 1953, and some consideration has been given to the radiation problems expected to result from external beam bombardments.

An analysis of the personnel exposures in the cyclotron area indicates that beta radiation has consistently been the largest contributor to exposure incidents. Improved target handling techniques and storage facilities provided in the pit area for materials of high specific activity have helped



4. DEPT. 2617 - URINALYSIS RESULTS - JULY-DECEMBER 1952 FIGURE



reduce the individual exposures. These storage facilities provide a safe and convenient location for targets which must decay to a suitable counting level.

Film badges and film rings have been used to determine which areas of the body need localized protection during typical target removal operations. The overall body exposures were considerably reduced by using lead-rubber aprons, gloves, and lead-covered welding masks. Shoulder areas were protected by a short jacket fabricated from 1 mm lead-equivalent rubber. Though somewhat unwieldy and uncomfortable this equipment provides adequate protection during the relatively short periods of time required for target removal and storage.

Isotope Separations

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A program has been initiated to explore the possibility of separating plutonium isotopes by electromagnetic methods. Operating equipment and procedures have been tested by making two complete thorium runs and one incomplete plutonium run. During these tests health physics services were supplied to the operating groups.

Protective respiratory equipment and complete clothing changes were provided in the more hazardous locations. Personnel decontamination facilities were also available.

Monitoring of individual exposure was accomplished by use of nasal swabs and urinalyses. The plutonium urinalyses for operating personnel indicated a mean concentration of 0.17 d/m/24 hour voiding. In two cases urine samples were obtained which were slightly above the MPL but within one week both of these decreased to a low level and in no case was a rising trend in the urine concentration observed. Nasal swabs furnished a qualitative measure of the recently inhaled contamination but the interpretation of these was hindered by the presence of other types of air-borne contamination from adjacent operations.

Localized air sampling was of value in determining which operations required additional precautions. Usually any operation involving handling of the source, receiver, or liner units resulted in elevated levels of air-borne contamination. High air contaminations resulting from source unit transfer operations are reflected in noticeable increases in surface contamination. Additional control measures for this operation are being considered.

On the basis of the meager amount of data obtained it is believed that calutron separation of plutonium isotopes can be performed within the bounds dictated by minimum protection standards. It should be recognized that considerable expense is involved in providing these minimum standards when materials of this type are handled.

CONTAMINATION CONTROL

Routine surface contamination surveys are used to monitor the house-keeping techniques in areas where radioactive materials are handled in significant amounts. Surveys are also conducted in other locations throughout the plant to determine levels of contamination. Results of these surveys are used as a guide in establishing the requirements necessary to prevent further spread of contamination. Routine reports containing a summary of the information obtained from each survey are distributed to responsible supervision.

Prevention of spread of contamination is effected by controlling movement of personnel and equipment among the various areas and by supplying appropriate protective clothing.

SPECIAL STUDIES

Alpha Absorption Corrections for Various Filtering Materials

When particle size determinations are made with a cascade impactor and a counting method is utilized in determining the mass of the alphaemitting material of known specific activity deposited on each stage, it becomes necessary to correct for the alpha losses in the filter paper and the glass slides. A method was devised to investigate the degree of the alpha losses associated with these collecting media. This method consisted of directly counting the alpha particles from the media, converting to mass, and comparing this to the mass determined by chemical analysis. Thus far, the investigation has concerned itself with various filtering materials which have been used as fifth-stage collectors.

Six media were studied: (1) millipore filter, (2) Whatman No. 41, (3) Whatman No. 44, (4) HV No. 70, 9 mils, (5) HV No. 70, 18 mils, and (6) CWS No. 6. For each media at least eleven air samples were taken from the aerosol generator containing UO_2 dust with a mass median diameter of about 0.8 μ . Sampling rates of 20 liters per minute were maintained through one-inch diameter filters. Samples were taken for a specified length of time and the mass of UO_2 was determined as previously mentioned. The ratio of counting mass to chemical mass of these determinations was then calculated and the averages are shown in Table 5.

TABLE 5

RATIO—COUNTING MASS TO CHEMICAL MASS

Filtering Material	Number of Samples	Ratio		
Mil lipore Media	36	0.89 ± 0.18*		
Whatman No. 41	32	0.489 ± 0.07		
Whatman No. 44	17	0.638 ± 0.07		
CWS No. 6	27	0.802 ± 0.13		
HV No. 70, 9 mils	11	0.861 ± 0.12		
HV No. 70, 18 mils	12	0.879 ± 0.17		

^{*}Standard errors of the mean.

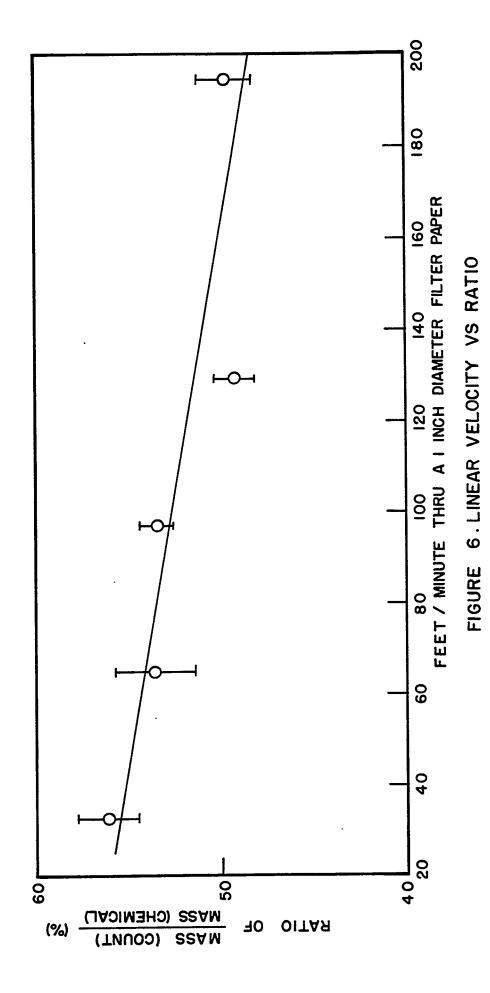
It is noted from Table 5 that the ratios for Whatman No. 41 and millipore media are at opposite extremes, being 0. 489 and 0. 892 respectively, It appears, in fact, that of the six papers investigated the Whatman filters constitute a class of their own and differ from the others by as much as a factor of two. The reason for this difference is not immediately apparent.

Along with this investigation a relationship between the alpha losses in the filter paper and the linear velocity through the paper was established by varying the air sampling rates from 5 to 30 liters per minute. Whatman No. 41 filters were used in this study. Samples were taken at four different linear velocities and the mass of UO_2 was determined in the same manner as above. Figure 6 shows the average ratios plotted against the linear velocity. It is noted that over this velocity range the data can be represented by a linear equation whose slope is negative and has a value of 0.043. This study indicates that the ratio is only slightly affected by varying the linear velocity over the ranges investigated.

Concentration of Beta-Emitting Decay Products on Surfaces of Uranium Castings

Personnel monitoring records for the normal uranium foundry and machine shop areas have occasionally indicated beta radiation dose far in excess of the maximum theoretically possible from a continuous exposure to a slab of the metal. An investigation lead to the discovery of abnormally high surface dose rates from certain of the metal castings with a maximum of 32.5 rep/hr having been observed. An analysis of the decay of a sample taken from one of the more active castings indicated a half-life of 24 days which is characteristic of thorium 234, the first daughter of uranium 238. An aluminum absorption curve for the same sample indicated a maximum beta energy characteristic of the second uranium daughter, protoactinium 234. Further evidence that the surface activity was due to the first two daughters of uranium was obtained when it was learned that the surface activity of a fresh casting was roughly proportional to the degree of radioactive equilibrium within the charge material. As expected the activity of the casting after the surface had been machined off was less than the normal value. (Here normal is taken to be 250 mrep/hr.)

From radioautographic studies no uniform pattern is observed but the activity appears to be deposited on all surfaces of the casting. Horizontal striations and evidence of an upward migration of the activity suggest the possibility that some flotation occurs in the mold. The general non-uniformity of distribution and the characteristic horizontal striation may be seen in Figure 7. The activity appears equally on the slag and casting surfaces in most instances.



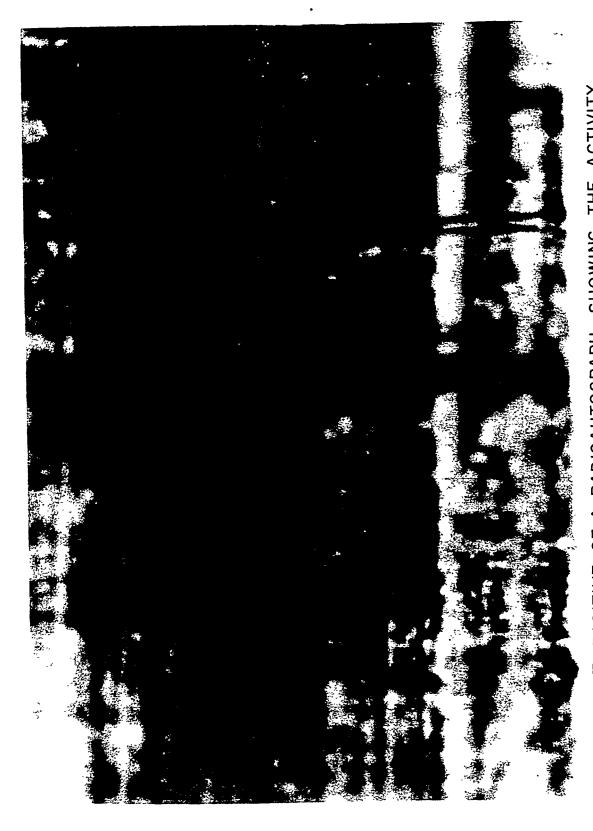


FIGURE 7. POSITIVE OF A RADIOAUTOGRAPH SHOWING THE ACTIVITY DISTRIBUTION ON THE SIDE OF A URANIUM CASTING (VERTICAL SURFACE)

 ThO_2 is probably the largest constituent of the active materials. ThC_2 and Th_3N_4 may be formed but these presumably react with air moisture to form ThO_2 .

Both graphite and magnesia gave equal results when an aged charge was used but an increase in the mold temperature at the time of pouring results in an increase of surface activity. This effect may result from the corresponding increase in the time before solidification.

Efforts to reduce the personnel exposures have been two-fold: (1) actual removal of the active surface layer, and (2) external protection, in the form of shielding, for employees. Up to 95 percent of the active layer is removed by a 5 to 15 minute wash in a 35 percent nitric acid solution. The rate of removal apparently depends upon the porosity of the corroded surface layer. It is expected that with further development this pickling process can be used to reduce the radiation hazard to that encountered in handling normal metal. Employee shielding has taken the form of heavy gloves which are of sufficient thickness to reduce the dose rate by approximately 50 percent. Of these two control measures, the nitric acid pickling appears to be the more desirable from the standpoint of a positive control.

Post-Exposure Studies on Urinary Uranium

An evaluation of enriched uranium excretions of employees who had been exposed to excessive air-borne concentrations of the metal and its compounds for periods of time ranging from two to eight years necessitated the termination of subsequent exposure of 21 employees who had been excreting high concentrations of the product-level material. Exposures were terminated by reassigning the 21 employees to work locations devoid of uranium or its compounds. Immediately following the reassignment complete physical examinations were conducted upon the group. No significant body damage was detected.

During the post-exposure period, urine specimens were submitted at a frequency of one per day for the first four weeks, thence after, one per week. Urinaryuranium concentrations exhibited tremendous fluctuations, hence a statistical analysis by the least-squares curve fitting technique was adopted. The employees returned to their original work when the excretion level, as determined by the best-fitting curve, coincided with the average uranium excretion rate of employees with whom the 21 originally worked. Within 200 days post-exposure, all of the 21 had returned to their original work locations.

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An average decay constant computed from the excretion data decreased by a factor of 10 at 200 days following cessation of the exposure and continued to decrease more gradually thereafter, thus preventing the promulgation of a "half-life" determination until more data can be obtained.

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Index No.

Y-858

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Subject Category: Radiological Safety

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CARBIDE AND CARBON CHEMICALS COMPANY A Division of Union Carbide and Carbon Corporation Y-12 Plant

W-7405-eng-26

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HEALTH PHYSICS PROGRESS REPORT

July 1, 1951 to December 31, 1951

E. G. Struxness, Department Superintendent

H. F. Ballenger, Editor



Oak Ridge, Tennessee March 15, 1952

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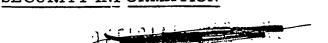
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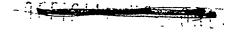
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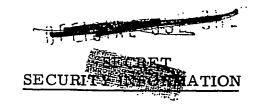
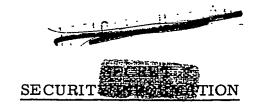


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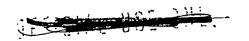
ORGANIZATION AND PERSONNEL

E. G. Struxness

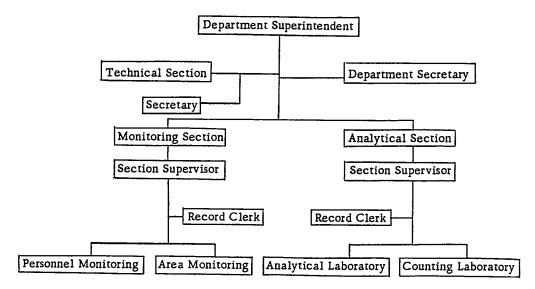
There has been a continued increase in the production and research activities carried on in the Y-12 plant with a resulting increase in departmental functions and responsibilities. This has led to the addition of several new members (16) to the Health Physics Department. Moreover, organization within the department has taken on an element of permanency and areas of responsibility have been more clearly defined. The distribution of personnel in the various job classifications as of the close of 1951 are as follows:

JOB CLASSIFICATION		NUMBER OF PERSONNEL
Equipment Cleaner		1
Junior Health Physics Technician		8
Health Physics Inspector		12
Laboratory Analyst		4
Junior Chemist		1
Associate Chemist		1
Chemist		1
Junior Health Physicist		4
Associate Health Physicist		1
Health Physicist		1
Industrial Hygienist		1
Record Clerk		2
Secretary		1
Health Physics Section Supervisor		2
Department Superintendent		1
	Total	41





The department has been organized into three sections, vis., Technical, Monitoring, and Analytical, and operates administratively in the following manner:



Separate visits by representatives of the department were made to the Health Physics Division of the Los Alamos Scientific Laboratory and to the Radiation Laboratory at the University of California at Berkeley on problems of mutual interest. One representative spent the month of November at the Nevada Test Site on problems pertaining to the fall-out of Atomic Weapons Cloud Contaminants in cooperation with the Los Alamos Radiological Safety Group.

In reference to the engineering and construction of new health physics facilities, a thorough investigation of the possibilities in Building 9711-1 led to the decision to consider an old alpha process building, Building 9202, rather than attempt to renovate Building 9711-1. The cost involved exceeded the value and permanency of this frame structure. Consequently, while temporary facilities for the Technical and Monitoring Sections were provided in Building 9711-1, plans were made to engineer and redesign the southwest wing (first floor) of Building 9202 for use as Health Physics laboratories and offices. The preliminary plans are about 90 percent complete and it is expected that a Change Recommendation will be submitted to the Atomic Energy Commission for approval within the next two months.

ORIENTATION and TRAINING

H. F. Ballenger

A significant increase in the scope of the training activities of this department has occurred during the period covered by this report. The functions can be delineated through four major programs. Each shall be described separately even though some existed concurrently.

Orientation Lectures for New Employees

As a part of the orientation program of the Y-12 Training Department approximately 78 one hour lectures were delivered to a total of 777 people who entered the employ of Y-12 during this time. The details of the lecture varied somewhat from time to time but, in general, it had as its main points: the purpose of the health physics work, the history leading to its present responsibilities, the types of radiation prevalent in the plant, the detection and protection methods employed and the important place of each individual employee in the success of the work of this department.

A. E. C. Fellows in Radiological Physics

Throughout the months of July and August the department personnel contributed a portion of the practical experience phase of the radiological physics training offered to approximately 20 men under the joint sponsorship of the Oak Ridge Institute of Nuclear Studies (ORINS) and the Oak Ridge National Laboratory (ORNL). In addition to the originally assigned group a few other men participated who were to assume responsibilities in directing the work of health physics in new A.E.C. installations. One other man came from the West Point Military Academy.

The students were conducted through a week's program. In order to orientate them properly to the over-all department activities they were taken first on a tour of the department facilities and the Y-12 plant. They were allowed to observe such operations as the Van de Graaff generator, the 86-inch cyclotron, the stable isotopes separators, the beryllium machine shop, and the salvage and slug canning operations in Building 9206. They were also taken to see an "alpha" and a "beta" installation. During the tour various monitoring and control procedures were pointed out that pertained to the particular operation.

The program for the remainder of the week consisted of an actual participation in the activities of this department. They performed all phases of the personnel monitoring and urinalysis procedures and carried out to completion actual field problems in area monitoring and air sampling. They were led in a discussion of the A.E.C. regulations covering the transfer and disposal of radioactive materials and the maximum permissible levels of radioactivity. Upon completion of the work each participant was given an evaluation sheet to fill out. In order to achieve a more candid opinion, the individual was asked not to sign the paper unless he so chose. The department personnel also were asked to evaluate the student. A summary of these evaluations indicate a very favorable reaction from both groups.

Interdepartmental Personnel

One consequence of the training presented to the A.E.C. Fellows was an expressed desire by some personnel in certain departments of Y-12 for an opportunity to participate in a similar program. Therefore, the details of the original program were modified to some extent in order to provide the material suited to the needs of this group. In the main it consisted of a greater emphasis on the practical applications of the work and a minimizing of the technical aspects. Those who shared in this program included the captains of the Fire Department, the Plant Shift Supervisors, a majority of the members of the Safety Department, five from Engineering and three from the supervisory staff of Material Production. They, too, were asked to evaluate the program and from their response evolved certain improvements and some possible future projects.

Health Physics Inspectors

The number of inspectors in the department has more than doubled within this report period. In line with the general department policy to strive constantly for better trained personnel, a course of study has been outlined and inaugurated for this group.

It is necessary for the inspectors to serve and converse with a widely diversified group. It is not imperative that they understand the technical details of each problem but they must be able to appreciate the important intrinsic ramifications and be able to anticipate the possible hazards involved. The course was developed with two objectives in view: first, the building of a good foundation in basic scientific knowledge on subjects pertinent to the groups they serve

and, second, an instructive emphasis on information and techniques essential to the accurate discharge of their assigned duties. This instruction also must stress fundamentals in proper deportment among those they serve.

The formal class sessions are 45 minutes in length and are conducted in two sections twice a week. While the new inspector is on the job he is working with someone who has acquired much of the knowledge necessary to perform the desired work. A well qualified supervisor, and to some extent the class instructor, is always in direct contact with all phases of their work to counsel on unusual problems which may arise.

INDUSTRIAL HYGIENE

Beryllium (W. H. Baumann)

During the last half of 1951, 1518 air samples were analyzed for beryllium. A summary of the air sampling, including type and location, is given in Table 1. Four positive results (> 2 $\mu gm/M^3$) were recorded and are listed separately at the bottom of the table. The volume of beryllium and beryllium oxide handled in the machine shop was low during this period, however, the control program was not relaxed.

Mercury (W. H. Baumann and M. E. Barnes)

Air Analysis. A total of 453 air samples were taken for mercury contamination at various locations throughout the Y-12 area. Considerable amounts of mercury are used in connection with the Alloys Development Project. Spillage of material presents the major problem since equipment modification and process alterations involve rather frequent disassembly of equipment. Good housekeeping coupled with exhaust ventilation and general air circulation provide reasonably effective control of mercury vapor contamination.

Employees are provided with shoes and issued freshly laundered work clothes wherever it is indicated that large amounts of mercury are handled. No smoking or eating is allowed in contaminated areas. Urine specimens are analyzed for mercury. However, their value is questionable because it appears, from our experience and from the literature, that the amount of mercury excreted is not related quantitatively to exposures.

A summary of the air samples taken during the period of this report is presented in Table 2.

Determination of Mercury in Urine. The urine samples, submitted by personnel in the A.D.P., are now being sent to K-25 for analysis. A study has been made of the K-25 method of determining mercury in urine and equipment has been arranged in Building 9733-4 for using this procedure. Solutions must be prepared and the method and equipment standardized before we are ready to perform the analysis here.

TABLE I

BERYLLIUM AIR ANALYSES

	E	Location	NO.	Beryllium Ai	Beryllium Air Concentration	µ gm/M³
, , , , , , , , , , , , , , , , , , ,	Type	of	Jo			
Alca	Sample	Samples	Samples	Minimum	Maximum	Average
Rervllium		Locker Room	111	1000. >	.083	.0007
Machine	Stationary	Machine Shop Area	861	< .0001	.263	.0003
1		Tool Grinding Area	126	<.0001	.078	9000.
done		Storage Room Area	117	<.0001	.041	.0003
Building	Operational and		61	<.0001	7.5	.42
	0	Influent	105	.0001	.380	9600°
	Filter House	Effluent	106	<.0001	.260	.0024
Building 9733-2	Operational and Breathing Zone		20	<,0001	.210	.010
Miscella- neous	Operational and Breathing Zone		11	2000. >	1.6	.18

•Four readings above 2 μgm/M³ ------7,5, 5.5, 2.4, 2.0

TABLE 2

MERCURY-AIR-ANALYSES

							·
	Type		Number	Mercui	y Air-Cor	Mercury Air-Concentration mg/M3	mg/M°
Area	of Samples	Location	of Samples	Min.	Мах.	Average	Remarks
A.D.P. Building	General Room and Working Atmosphere	General Area Samples	87	00.	.25	90.	
1	Sump Area	10' Radius of Sump	18	70.	.60	.19	
	Operational and Breathing Zone	In Area of Equip- ment and Test Table	318	00.	.60	90.	
Van de Graaff 9201-2	Van de Graaff Operational and 9201-2 Breathing Zone		23	.00	.17	20.	
9733-2	Operational and Breathing Zone		4	00.	.22	.07	

Residual Chlorine Content of Water in Y-12 (M. E. Barnes)

The Health Physics Department was asked to determine the residual or free chlorine content of the water in the fresh water lines of the area. The water which enters the purification plant supplying Y-12 is treated with chlorine. Part of the chlorine is consumed by the impurities in the water. However, after the filtration processes the chlorine content of the water entering the mains is adjusted to the range between 0.7 and 0.8 parts per million parts of water (ppm). The concentration is maintained at almost precisely 0.75 ppm and is checked continuously by an automatic sampler-analyzer-recorder. The concentration is also checked periodically by the ortho-tolidine dihydrochloride method. The water delivered to Y-12 should lose little, if any, chlorine in the mains, therefore, it should possess the original 0.7 to 0.8 ppm free chlorine.

Two independent methods for determining residual chlorine were used in this study. The ortho-tolidine dihydrochloride method was chosen since it was used by the water purification plant and is also recommended by the U.S. Public Health Association. A simple colorimetric methyl orange determination² was also used.

The first attempts to analyze the water for residual chlorine gave very erratic results. Water samples were taken in clean erlenmeyer flasks with ground glass stoppers and brought to the laboratory for analysis. It was learned that the residual chlorine excapes from the water upon standing for even a few minutes, especially if the temperature of the water is allowed to increase. Both methods were then altered to be used as field methods. All further samples were analyzed immediately after they were taken from the sampling tap.

After the change was made, the ortho-tolidine dihydrochloride method gave results which checked reasonably well with the limits set up at the purification plant. The methyl orange method, however, still gave erroneous results. The pH of each sample was checked and it was found that this did not possess enough variation to account for the unsatisfactory results obtained by the methyl orange method. Further investigation revealed that the indicator grade

^{1.} Standard Methods for the Examination of Water and Sewage, Ninth Edition, 1946, pp. 92-98.

^{2.} Industrial and Engineering Chemistry-Analytical Edition, Vol. 19, May 1947, pp. 342-343.

of methyl orange was not pure enough for this determination. Several grams were recrystallized three times and a new reagent made by using the purified crystals. The results obtained on water samples, after these modifications, checked with the ortho-tolidine method within the limit of error.

Engineering and Health Physics personnel selected four sampling locations. These were chosen because they yielded water from all the mains supplying Y-12. The locations and residual chlorine contents are given in Table 3.

It should be noted that the residual chlorine content of the water from the isotope laboratory in Building 9211 fluctuated. A study of the water in various parts of 9211 was made on November 1. The results, using the ortho-tolidine dihydrochloride method, are as follows:

Location	Time	Residual Chlorine (ppm)
Women's Rest Room (First Floor)	2:35 P.M.	0.75
Isotope Laboratory	2:40 P.M.	0.35
Hexone Operating Room (Third Floor)	2:42 P.M.	0.60
Equipment Cleaning Room for Isotope Laboratory	2:50 P.M.	0.30
Loading Dock South East of Building	2:55 P.M.	0.35

Since the residual chlorine content of the water throughout the building was not low and since the concentration of free chlorine in the water had increased four days later, the condition seemed to be only temporary and not considered to be serious.

Note, also, that the chlorine content in Building 9711-1 is low. This can be explained by the fact that this building had been in stand-by for four years. Water had been stationary in the pipes and, no doubt, some rusting had occurred. The volume of water used in this building is not large and, therefore, the water which was tested had been in the pipes for longer than is required for accurate sampling.

TABLE 3
RESIDUAL CHLORINE IN WATER

	T + 6	Date	Time	Method	
Bldg.	Location	Date	<u> </u>	Ortho-tolidine	Methyl
				Dihydrochloride	Orange
				•	
0011	Isotope Lab	10-30-51	10:58 A.M.	0.70	0.70
9211	Botope Eas	11-1-51	12:55 P.M.	0.15	0.20
		11-5-51	10:45 A.M.	0.60	0.70
		11-6-51	12:50 P.M.	0.50	0.70
		11-7-51	10:52 A.M.	0.50	0.70
		11-8-51	10:32 A.M.	0.35	0.45
		11-9-51	11:59 A.M.	0.20	0.20
		11-12-51	10:18 A.M.	0.50	0.85
		11-13-51	9:50 A.M.	0.40	0.50
				0.70	0.70
9206	Decon-	10-30-51	11:15 A.M.	0.75	0.70
	tamination	11-1-51	1:10 P.M.	0.75	0.80
	Room	11-5-51	10:55 A.M.	0.75	0.70
		11-6-51	12:57 P.M.	0.75	0.80
		11-7-51	11:00 A.M.		0.75
		11-8-51	11:07 A.M.	0.75	0.80
		11-9-51	11:17 A.M.	0.75	0.85
		11-12-51	10:03 A.M.	0.75	0.85
		11-13-51	9:59 A.M.	0.70	0.00
9723-25	Women's	10-30-51	11:25 A.M.	0.70	0.70
9120-20	Change House		1:23 P.M.	0.75	0.70
	Change Home	11-5-51	11:05 A.M.	0.75	0.75
		11-6-51	1:15 P.M.	0.65	0.75
		11-7-51	11:10 A.M.	0.70	0.75
		11-8-51	10:45 A.M.	0.50	0.55
		11-9-51	10:38 A.M.	0.50	0.70
		11-12-51	9:53 A.M.	0.75	0.80
		11-13-51	10:07 A.M.	0.70	0.80
		10 00 51	13 04 A M	0.35	0.35
9711-1	Men's Rest	10-30-51	11:34 A.M.	0.30	0.35
	Room	11-1-51	1:37 P.M.	0.30	0.45
		11-5-51	11:15 A.M. 1:23 P.M.	0.15	0.25
		11-6-51	1:25 A.M.	0.45	0.60
		11-7-51	11:25 A.M. 11:19 A.M.	0.40	0.50
	•	11-8-51		0.45	0.60
		11-9-51	10:25 A.M. 10:23 A.M.	0.35	0.60
		11-12-51	· · · · · · · · · · · · · · · · · · ·	0.20	0.25
		11-13-51	10:16 A.M.	0.20	

A determination of the residual chlorine content of the water in Building 9204-4 was requested since this building had been in stand-by for several years and has recently been re-opened. Results found were as follows:

Location	Date	Residual Chlorine (ppm)
Men's Rest Room in Base-	11-12-51	-
ment, First Wash Basin	11-13-51	0.7
	11-14-51	0.6
Track Floor - Sink Near	11-12-51	0.5
First Aid Station	11-13-51	0.5
• •	11-14-51	0.4
Track Floor - Mop Sink	11-12-51	0.5
Near West End of Track	11-13-51	0.5
	11-14-51	0.5

All of the determinations in Building 9204-4 were made using the ortho-tolidine dihydrochloride method at approximately 4:15 P. M.

Water from drinking fountains cannot be tested because the temperature is too low for the ortho-tolidine dihydrochloride color to develop fully. If a sample is taken and allowed to stand until the temperature is high enough for full color development the free chlorine escapes.

Hexone* (M. E. Barnes)

The Industrial Hygiene section of the Health Physics Department was asked to investigate the fire hazard created by the hexone-vapors given off from the zirconium purification process in Building 9211. Since hexone vapors in the air are also a health hazard for the operators working in the area (the maximum allowable concentration is 150 ppm or 0.615 mg per liter of air³), it was decided to work on the problem from the health position. If the concentration of the vapors in the air is below the amount allowed for reasons of health it is definitely not a fire hazard. The concentration necessary for an explosion exceeds the amount necessary to produce toxicity by a factor of 80.

^{*} Hexone is methyl isobutyl ketone or 2-pentanone, 4-methyl ketone.

^{3.} Patty, F.A., et al., <u>Industrial Hygiene and Toxicology</u>, <u>Interscience Publishers</u>, Inc., New York, 1948, Vol. II, page 940.

The method of analysis chosen was an iodometric method given by Elkins. The sample was collected on silica gel in a U-tube, extracted with water, treated with iodine and titrated with sodium thiosulfate. Results on six air samples were unreasonably low. Since only two parts of hexone are soluble in 100 parts of water at 20°C, it seemed possible that the total amount of hexone present was not extracted by the water. The remainder of each sample which contained water and undissolved silica gel, was then titrated. The results were much higher. Table 4 records these results.

TABLE 4

HEXONE AIR ANALYSIS - BUILDING 9211

		Sample*			Sample
	Collection	Water	Remaining		
Area	Time	Extract	Mixture	Total	Total
		ppm	· ppm	ppm	ppm
Hexone Storage					
tank nearest		1			1
North wall	10 min	3.2	12.9	16.1	7.0
(breathing zone)	20 min	0.9	2.0	2.9	
General Area	10 min	< 0.1	5.3	5.3	3.3
(breathing zone)	20 min	0.4	3.3	3.7	1.6
Inside filter	2 min	24.9	53.0	77.9	11.6
press hood along	3 min				28.7
East wall	5 mm	12.0	27.5	39.5	

^{*}Sample collected on 10-31-51

The procedure reported by Elkins was modified to incorporate this finding. Another group of air samples was taken in the operating room in Building 9211 on November 12. These results are also recorded in Table 4.

Care must be taken not to place too much confidence in these results. At the present time there is no available method for checking the efficiency of the collection of the sample on the silica gel. To do this it is necessary to have a device which will deliver constant known concentrations of hexone in air which could be sampled to determine the collection efficiency of the silica gel. This should be deter-

Sample collected on 11-12-51

^{4.} Elkins, H.B., Chemistry of Industrial Toxicology, John Wiley and Sons, Inc., New York, 1950.

mined for each new portion of silica gel which is used since some silica gel is alcohol-treated, or reclaimed, and would not be suitable for ketone determinations.

PERSONNEL MONITORING

Film Badges, Pocket Chambers and Rings (D. H. Reed)

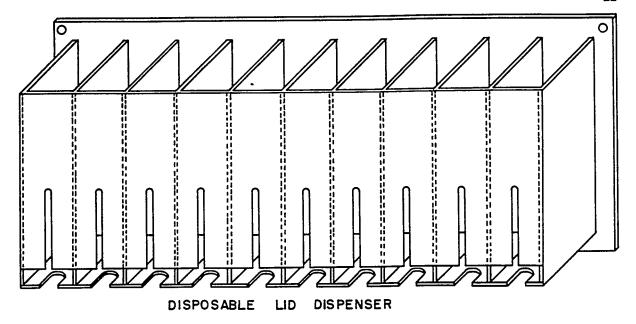
The department processed 11,700 film badge meters during this period. Of these 5,200 were assigned to people in working areas where a potential beta-gamma radiation hazard is known to exist. The films are processed weekly. Sixty-five hundred were worn by people who were classed as visitors to the above area and were assigned a visitor badge for the one day. These meters are processed and a new film put in after each days use. The date on which the meter is worn is X-rayed on the film after it is returned for processing.

A total of 122 people were supplied with gamma sensitive pocket chambers and 78 people with thermal neutron sensitive chambers. The exposures on pocket chambers are determined daily and the meters re-charged using the Keleket charger reader.

Rubber finger rings are still being used at this time since the recently designed plastic ring with a screw cap, mentioned in the previous progress report, is not yet available for use. However, it is expected that the rubber rings will be discontinued in the near future in favor of the earlier type plastic rings. The badge number of the individual to whom it is issued and the date will be X-rayed on the film. The rings will be furnished and developed on a weekly basis.

Urine Collection and Urinalysis Results (S. R. Bernard)

Considerable modification has taken place in the urine collecting program. The most pronounced change occurred in the type of container for collecting the specimen. Waxed paper cartons have replaced the glass specimen bottles. A new problem was thus created in the distribution of the cartons. It was unsightly, as well as inconvenient to the users, to simply stack the cartons and lids on a shelf or table at the collection table. As a consequence both lid and carton dispensers were designed and are now being built. Figure 1 shows the features of these dispensers. The carton dispenser consists of a rectangularly shaped box long enough to hold about twenty cartons. The cartons are loaded through the top. At the bottom there is a pair of spring loaded hinges which allows the carton to hang from the dispenser but prevents it from falling out unless the carton is pulled. The lid dispenser consists of a rectangularly box long enough to hold approximately thirty lids. The lids are loaded through the top and



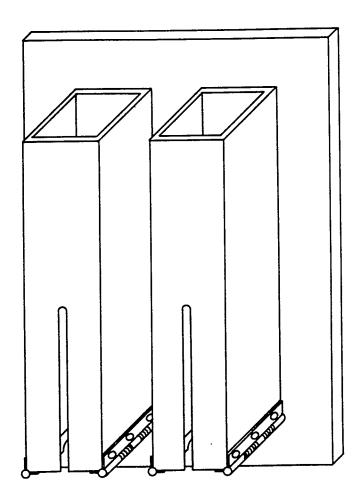


FIGURE I. PAPER CARTON DISPENSER

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rest on the bottom of the box. A slot across the front of the box and wide enough to allow one cap to slide through is provided at the base for the removal of the cap. To aid in this removal a U shaped hole is located in the bottom to allow the user to obtain a hold on the cap.

The change to the paper cartons also involved a need for a means of transporting the cartons. As a result, a tray capable of transporting fifteen samples was designed and built. Figure 2 shows the design of the tray. The tray consists of two pieces of plywood spaced approximately four inches apart and joined on each of two sides by hardwood runners. The upper shelf of the tray has holes provided which are large enough to admit most of the paper carton (one pint size). This shelf prevents the cartons from falling out in case the tray is tilted. The bottom of the carton rest on the lower shelf. Each runner is provided with a tongue on the top edge and a groove on the bottom edge for interlocking when the trays are stacked. The trays are custom fabricated to fit two available refrigerators. Because of the tongue and groove arrangement they can be slid in and out of the refrigerators with a minimum of effort. To transport the trays two trucks were also designed and built.

A total of 3,362 urine samples were analyzed for uranium content. Of this number, 1,759 required the enriched uranium analytical procedure while the remaining 1,883 underwent a normal uranium analysis.

Two major alterations in the uranalysis program went into effect at this time. They were: (1) the modification of the method for analyzing urine for enriched uranium, and (2) the replacement of the monthly urine sample for a weekly urine sample. An investigation of the method for analyzing urine for enriched uranium necessitated a cessation of analytical activities for a period of seven weeks, in order that all available facilities could be concentrated upon the investigation. This study revealed that the method was faulty in that results were low by a factor of approximately 2, and the error in a single measurement varied by -20% (50% error). The modified technique brought an increase in the recovery of uranium and a reduction in error by a factor of 2. Changing from the monthly sample collection came about as an outgrowth of a desire to study the "Monday morning" and the "Friday evening" type of samples as they relate to recent

^{5.} Ross, D. M., ANALYTICAL RESEARCH, <u>Uranium in Urine</u>, this report.

^{6.} Neuman, W.F., <u>Urinary Uranium as a Measure of Exposure Hazard</u>, Health and Biology Section. University of Rochester, UR-82, July 1, 1949.

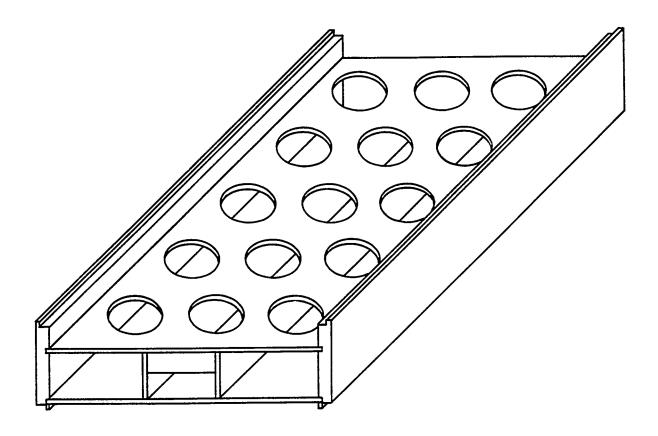


FIGURE 2. CARTON TRAY

exposure and stored uranium. The weekly samples taken during this period correspond to the "Friday evening" sample. In the future sampling will be changed to the "Monday morning" type. It is intended to make this change as soon as details can be arranged.

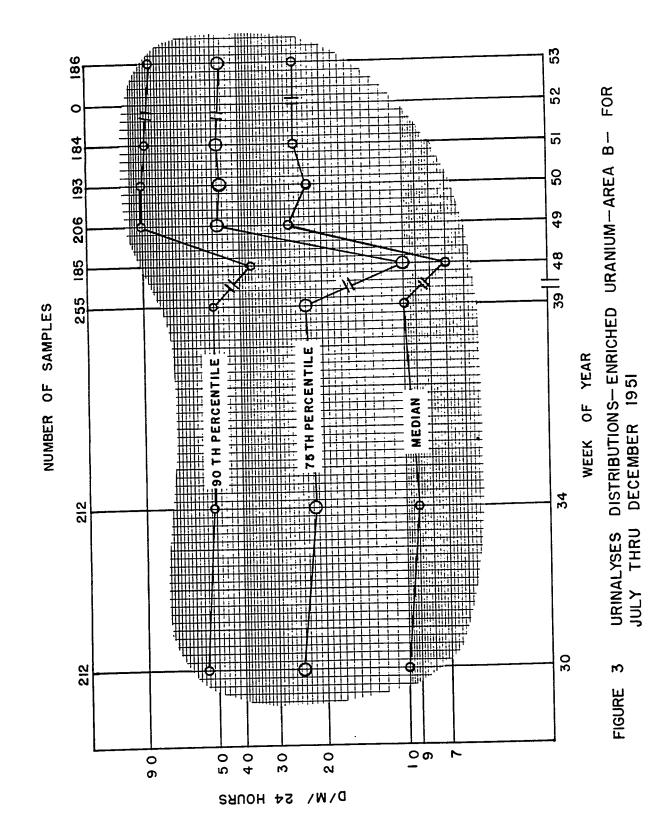
In addition to the reasons stated above, the monthly urine was considered inadequate for the purpose of estimating exposures and correlating these with air concentration measurements. Ideally, the process of taking daily urine samples would be best suited for a correlation study but since this exceeds the limit of practicality, a compromise was effected in the use of the weekly sample. Initiating the weekly sample was given impetus by the more accurate analytical technique.

As usual, the cumulative percentage polygons are used to show the distribution of urinary uranium concentration. However, with the process of taking weekly urine samples in effect, numerous distribution curves would be required. Hence, three percentiles (cumulative percentages) taken from polygon "working curves" are plotted versus the time (week of sample) in order that the trend of urinary uranium concentrations may be indicated. The construction of these are accomplished to the following plan:

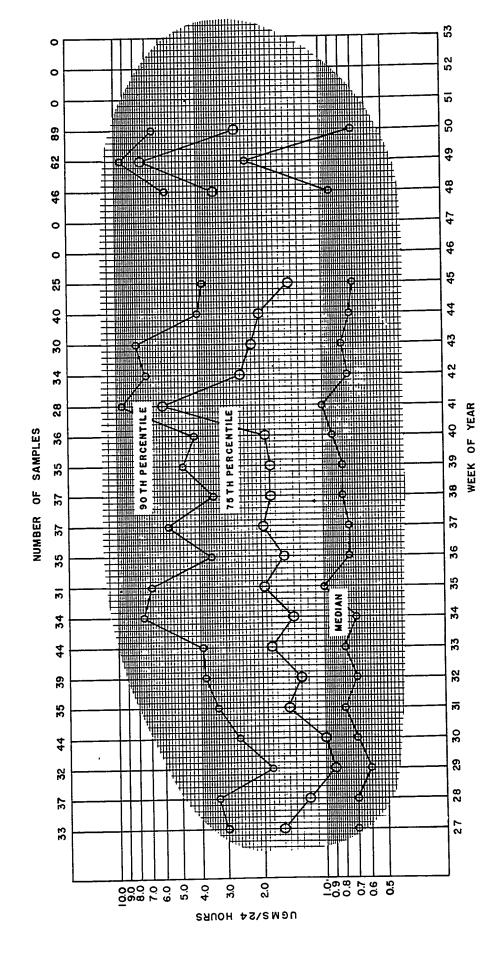
Urinary uranium concentrations are classified for each week of urine sampling. The frequencies, beginning at the lower classes are cumulated, then converted to percentages. A plot of these cumulative percentages versus the upper limit of the class constitutes the cumulative percentage polygon "working curve." Three percentiles, the 50th, 75th and 90th are held constant and the intercept that each makes with the abscissa is plotted versus the week of the sample.

Essentially, a cumulative percentage polygon is the integral of a distribution curve and the percentiles are the percent of the total area under this curve. Hence, the intercept on the abscissa represents the limit of the range of urinary concentrations for 50, 75 and 90 percent of the employees excreting these concentrations.

Figures 3, 4 and 5 contain the distribution of urine concentrations found in this period. The discontinuance of the urinalysis program mentioned above is responsible for the break in the lines of Figure 3. This figure also reflects the increased recovery of uranium from urine in that the limit for the percentiles was greater by a factor of 2 or more beginning with the 48th week. Actually, the urinalysis program was resumed on the 47th week where the limits for the per-



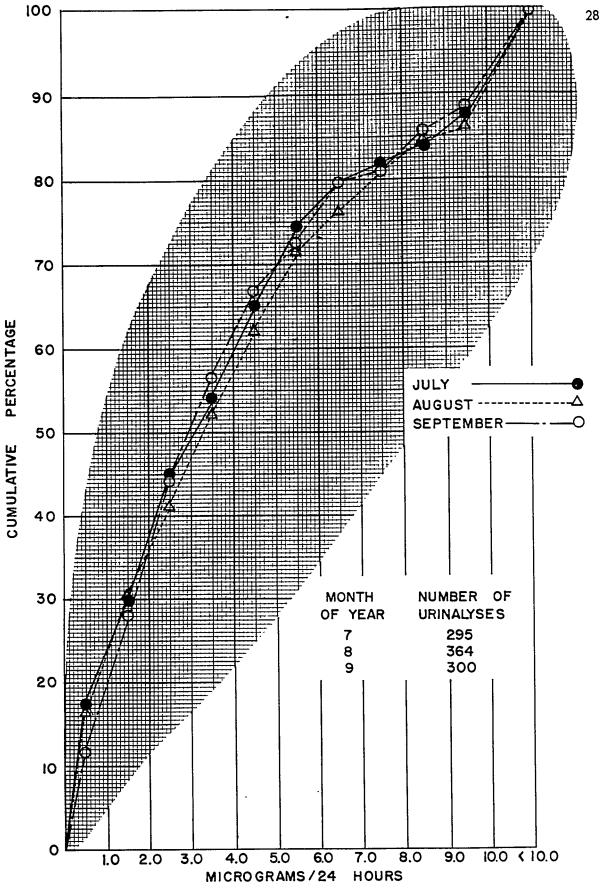
}



1981 DECEMBER THRU FOR JULY -AREA A DISTRIBUTION - NORMAL URANIUM ---URINALYSES FIGURE 4

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URINALYSES DISTRIBUTIONS - NORMAL URANIUM-FIGURE 5 DECEMBER 1951 AREA B- FOR JULY THRU

centiles is less than the preceding ones. During the 47th week the analytical results shown by the laboratory control chart were negatively biased (low), thus shifting the distribution of uranium excretions towards lower concentrations. In the succeeding weeks the method was back in control as indicated by the control chart and the percentile limits.

With the increased recovery of uranium from urine, the limiting value for the 90th percentile exceeds the maximum permissible urinary concentration of 70d/min/24 hrs. Since this includes only 90% of the employees an additional 10% exceed this value also. In this 10% are a few employees who consistently excrete uranium in excess of the maximum permissible concentration while the rest occasionally excrete this but most frequently excrete lesser amounts. The few who are consistent will be removed from operations for such time as is necessary to reduce the level of uranium concentration found in their specimens. It is intended that biological elimination rates of the uranium may be more accurately determined from the urine data collected from these employees.

Figure 4 indicates a slight increase for the 90th percentile. However, this is probably not significant since these levels are exceptionally low and the distributions are comprised by only 30-40 employees.

From Figure 5, no significant difference is noted for the first half of this period. Urine sampling in this area ceased for the time required for the analytical investigation. When the weekly urine sampling frequency went into effect, the maximum number of samples which could be handled by the laboratory allowed only sampling from employees in Area "A" (Building 9206) and Area "B" (enriched) program. It became evident that the Area "B" (Building 9212) normal program could not be reinstated until more laboratory facilities are made available. It is estimated that more facilities will be ready by May, 1952. Area "B" normal program will be reinstated at this time.

AREA MONITORING

Storm Sewer Water Analysis (M. E. Barnes)

During this period the most contaminated sample was found during the week of November 10-16. The uranium content was 0.9 Hgm per 100 ml of water and the alpha count gave 2.1 counts per minute per 100 ml of water. Since this sample is low and all others were even lower the disposal of uranium and its compounds appears to be well under control in Y-12. Indications lead to the conclusion that the time, equipment, and space used in analyzing the samples are not warranted. The uranium analysis will be discontinued, therefore, as of January 1, 1952. Other materials being discarded into the storm sewer are considered more hazardous. It was decided by the Health Physics Technical Staff that the polonium content of the sewer water should be known. Plans call for the taking of samples every four hours. These will be collected in cardboard cartons instead of glass carboys. No tests have been conducted as yet to determine whether the ferric ion or other materials present in the water will interfere with the plating of the polonium. Table 5 records the analytical data collected on the storm sewer samples.

Shipments and Intraplant Transfers (D. H. Reed)

A total of 946 shipments were inspected for radiation and contamination in accordance with Standard Practice Procedure #20 B. Standard Practice Procedure #37 A requires that any material and equipment to be transferred from certain buildings are to be inspected for radioactivity before being removed from these buildings. The buildings which are listed are those which have a history indicating possible contamination of the contents of the building. No record is kept of the number of these inspections. However, at the time of the inspection a tag is attached to the equipment of material indicating special handling instructions if required.

Air Sampling (Uranium) (C. M. West)

As a result of increasing uranium operations prior to and during the report period, the Health Physics Department has had to further expand its air sampling program by hiring additional inspectors and by increasing the number of permanent air samplers.

TABLE 5

ANALYSIS OF STORM SEWER WATER

		Uranium				
Identification	pН	μgms/100 ml	counts/min/100 ml	Efficiency (%		
1-187-63		0.4	0.01	4 8.		
1-194-64		0.4	0.01	48 .		
1-201-65	7.1	0.4	0.2	47.9		
1-208-66	7.4	0.6	0.3	49.5		
1-215-67	7.2	0.3	0.01	48.6		
1-222-68*						
1-229-69	7.2	0.3	0.1	45.6		
1-236-70	7.4	0.5	0.2	45.1		
1-243-71	2.5	1.2	0.1	50.0		
1-250-72	7.4	0.3	0.1	47.9		
1-257-73	6.9	0.2	0.04	47.4		
1-264-74	6.8	0.1	0.04	45.6		
1-271-75	7.2	0.4	0.3	49.5		
1-278-76	3.2	0.7	0.3	50.2		
1-285-77	6.8	0.2	0.1	48.6		
1-292-78	6.9	0.4	1.3	44.7		
1-299-79	7.5	0.5	0.3	47.9		
1-306-80	7.2	0.6	0.02	50.0		
1-313-81	7.0	0.4	1.6	50.0		
1-320-82	7.1	0.9	2.1	50.0		
1-327-83	7.4	0.6	0.4	50.0		
1-334-84	7.9	0.7	0.4	50.0		
1-341-85	7.9	0.6	0.08	50.0		
1-348-86	7.2	0.7	0.6	50.0		
1-355-87	7.3	0.3	1.3	50.0		
1-362-88	7.3	0.5	0.1	50.0		
* No complete		200 0144	C 1.35			

^{*} No sample submitted. 200 0.44 C 0.35 dis 0.70

Breathing zone samples have been used to supplement the operational samples. An operational sample is one taken at a specific location near a particular operation. Breathing zone samples are taken by following the operator as closely as possible during the course of a particular operation. The location of these samples is noted on the sample report card in terms of its three dimensions from the point of contamination. It has been found that the use of this type of sample permits more accuracy in the determination of the sources of high general air concentrations.

Of the 1650 air samples taken during the months of July, August and September 65.2% were of the general air (GA) type. During the last three months of the year 62.6% of the total of 2569 samples were of this type.

The uranium air sample results for the period, July 1 to September 30 are summarized in Table 6.

TABLE 6

URANIUM AIR SAMPLES - 3rd QUARTER ~ 1951

Type of Material	Area	No. of Samples	Av. Time of Samples	Weighted Mean	Type of Sample	Respiratory Equipment
		Min	· · · · · · · · · · · · · · · · · · ·	d/m/M ³		
	A A	54 40	. 11	2637	BZ	Yes
Normal T1			50	13	BZ.	No
Normal Insoluble	A	37	73	235	GA	Yes
	A	42	68	395	GA	No
	В	232	27	463	BZ	No
	В	859	349	113	GA	No
	В	12	8	1192	BZ	Yes
Soluble	В	93	24	101	BZ	No
Enriched	В	82	88	25	GA	No
	В	12	3	3212	BZ	Yes
Insoluble>	В	133	18	422	BZ.	No
	В	54	65	215	GA	No

An inspection of these tables show that, in general, the weighted mean air densities have remained of the same order of magnitude. Weighted mean concentration for GA type of sample in "A" area (Building 9206) where respiratory equipment is worn shows a decrease. This decrease was anticipated since operations that have run consistently high in the past have been removed from this area.

There is a marked increase in air concentrations on BZ samples taken in the enriched area of Building 9212 where no respiratory protective equipment is worn. This increase is evident in samples involving both soluble and insoluble materials. These higher results are due, in part, to a sampling emphasis on operations which usually show high air borne uranium concentrations. Steps are being taken which, it is believed, will result in a lowering of the air borne contamination associated with these operations.

Several portable air samplers were designed and constructed at this time. They were made by mounting a flow-meter and needle valve on a small metal shelf which, in turn, is bolted to a Gast air pump. The portable units have proved to be very useful and much less cumbersome than the dolly-mounted samplers. Figure 6 shows the design of the sampler.

The use of a disposable carton for collecting and transporting filter paper used for air and smear samples was brought under consideration. It was found to be feasible and economical. A means of carrying and dispensing the cartons was then devised. The dispenser consists of three aluminum tubes, each of which holds nine cartons, clamped in a semicircle and equipped with a carrying strap. An aluminum washer, welded in the bottom of each tube, prevents the cartons from falling out. The carton can be slipped out through a slot located just above the bottom of the tube. A hole in the washer facilitates the removal by allowing one to push up and out on the carton with one finger. Two advantages are gained by this method of transporting the cartons:

- 1. The inspector's hands are free for work.
- 2. Danger of contamination from contact with contaminated surfaces is reduced to a minimum since the dispenser does not have to be laid down to remove or replace a carton.

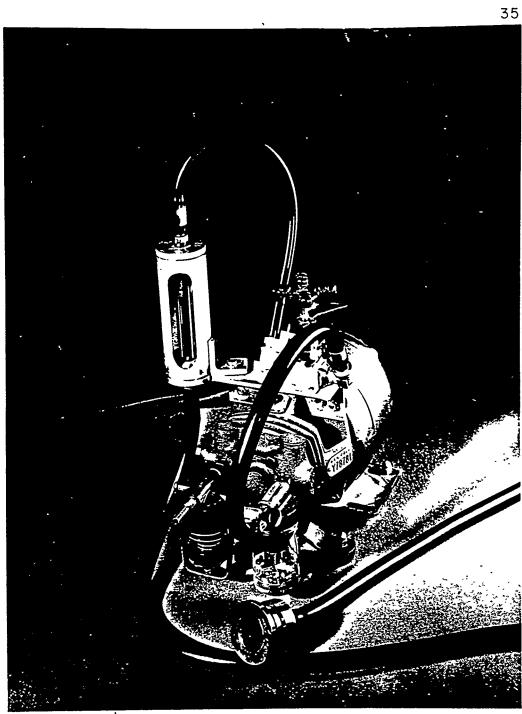


FIGURE 6. PORTABLE AIR SAMPLER-(SAMPLER HEAD INSTALLED)

ACCELERATORS

L. C. Emerson R. O Wollan

Introduction

The increase in health physics needs, as a result of the rapid expansion of the accelerator program, has necessitated that two additional persons from this department be assigned to this problem of external radiation hazards. Future expansion may require the acquisition of additional personnel.

No major changes in policy have evolved during this report period. The principle health physics activities continue to center around a program of contamination control. Minor procedural changes aimed toward a more effective safety program are to be expected.

The maximum permissible exposure to fast neutrons has been lowered in accordance with our policy of adjusting MPL values to conform with the latest available data. The present flux values are those obtained by the Theoretical Physics Section of the Oak Ridge National Laboratory Health Physics Section from a "Monte Carlo" calculation.

86" Cyclotron

General Progress. This report period has seen a rapid development of the facilities in this area. Large innage increases have been obtained as a result of more reliable equipment and standardization of operating procedures. Generally, the increase in innage has resulted in an increase in radiation hazards. This department, in cooperation with cyclotron supervision, has had the responsibility for setting up safe and non-restrictive operating procedures. One of the biggest problems associated with this responsibility has been the orientation of new personnel assigned to the cyclotron area. Present policies place much of the responsibility for observing safe practices on the crew chief in charge of the actual cyclotron operations. This was deemed necessary because of the impracticality of having health physics services available on a 24 hour basis. Routine services are furnished during the normal five day week with emergency service being on call at any time. However, this arrangement

is not without its limitations. It has been difficult to impress the operating crews with the importance of the health physics program especially when this program appears restrictive in nature. The solution to this problem will not be accomplished immediately. An intensified orientation and education program is planned to more thoroughly acquaint personnel with the need for health physics services.

Gallium-67 Production. No program in this area probably presents a greater external radiation problem. The large (p, n) cross sections for isotopic zinc, long bombardments at high currents, and the high specific activity of radio-gallium all combine to produce extremely high radiation fields in the vicinity of the target. Radiation levels exceeding 25.0 r/hr have been observed several feet from the target. At best, target removal operations result in exposures in excess of the weekly MPL to several persons. When more refined equipment becomes available, this problem should be lessened considerably. This equipment is described elsewhere in this report.

Neutron Flux Outside Maze. A survey of the fast neutron flux existing at the outer entrance of the maze has been completed. The instruments used were a Uranium-235 paraffin moderated fission chamber and a boron trifluoride proportional counter with a Hanson moderator. The values close to the concrete shield may be low because of the directional effect introduced by the moderator. The measurements were normalized to a 500 microampere beam of 19 MEV protons. The results of these measurements are shown in Figure 7. To increase the allowable working time in the area immediately outside the maze a sliding neutron shield has been installed at the entrance. This shield consists of an eight inch slab of paraffin, and is mounted on overhead rollers. Suitable interlocks are provided. It can be seen from Figure 7 that this shield is effective in reducing the flux to tolerable values except at the edges. The high values at the edges and at the top are due to neutrons which are scattered through the thin shielding adjacent to the paraffin. Methods to reduce this will be considered.

Summary of A Near Accident. A near accident occurred during this report period involving an exposure of two individuals to an intense neutron flux for a short period of time. This occurred when the persons involved entered the inner maze adjacent to the cyclotron area while, unknown to the individuals, the cyclotron was in operation. A three weeks tolerance dose was received in the one minute they were in the area. Immediately following this incident a temporary door was erected blocking the entrance to the area. This door was used until the sliding neutron shield was installed.

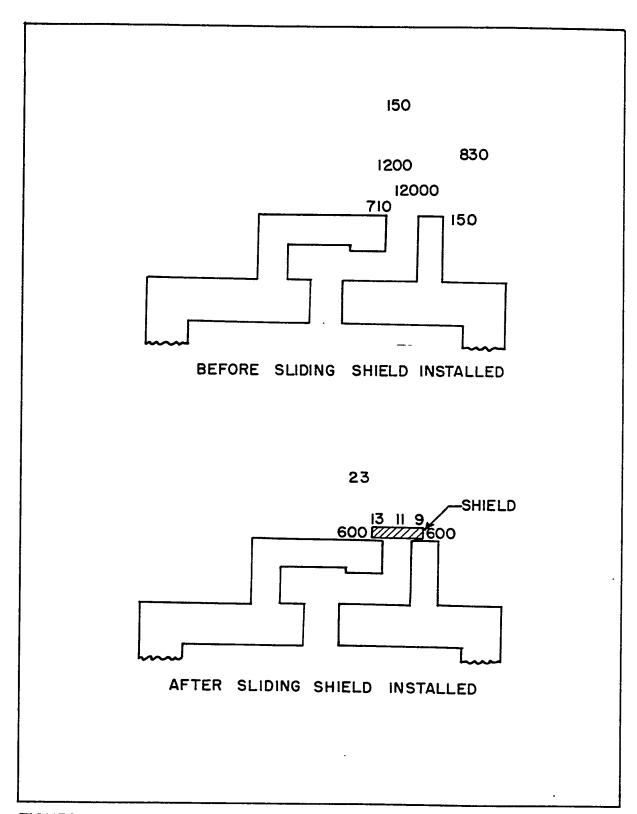


FIGURE 7 NEUTRON FLUX OUTSIDE MAZE IN NEUTRONS/cm-sec

Cataract Examination. The routine cataract and blood cell examinations discussed in the last progress report have been started. Reexaminations follow at three month intervals. In the examinations conducted to date no unusual findings have been reported.

Exposure Analysis. The average weekly exposure to penetrating radiations in the cyclotron area has risen above that noted for the last report period. In an effort to determine the origin of these exposures an analysis was made of the various contributing causes. This analysis covers the period from August 11, 1951 to December 31, 1951. All records are incomplete before August 11. Average weekly exposures are broken down into two groups: (1) those received by persons who worked in the cyclotron area and (2) those received by persons who actually were exposed to radiation in the cyclotron area. Also investigated were the results of a time study of the causes of innage loss. A fair degree of correlation was found between the average exposure of persons who were exposed to radiation in the cyclotron area and the amount of time spent by the operating crews in making adjustments or repairing failures of cyclotron components. This correlation is shown in Figure 8. However, these results are not surprising. It would be expected that the operating crews would receive the largest number of exposures and that these exposures occur during times when conditions require the crews to be near the primary sources of radiation. The correlation does indicate, however, that the radiation causing the exposures comes from induced activities in the cyclotron itself rather than produced activities in the targets. As expected, there is no correlation between the exposures and the number of weekly microampere hours run. Saturation of the materials with high specific activity is usually reached before the termination of the run.

Air Borne Contamination. Sixty-one air samples were obtained during this period. The results are divided into four groups which are determined by the type and location of each sample. The results shown in Table 8 are weighted with time. Respiratory equipment was worn in all areas when the air borne contamination level was consistently above 70 d/min/ M^3 .

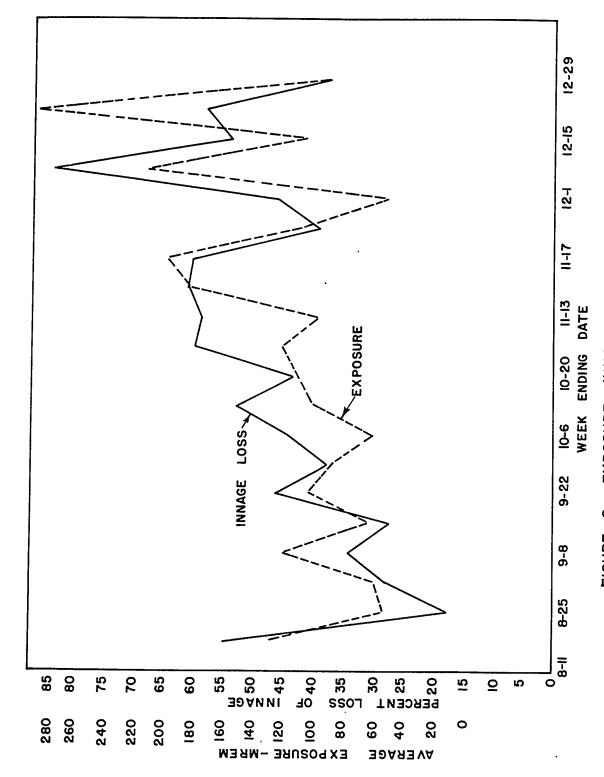


FIGURE 8. EXPOSURE - INNAGE CORRELATION BY WEEKS

TABLE 8

AIR BORNE CONTAMINATION IN 86-INCH
CYCLOTRON AREA

Area	Number of Samples	Average Time Min	Weighted Mean d/m-M ³
Cyclotron, General Area	22	20.5	264
Cyclotron, Operational	20	18,4	15,226
Cyclotron, Room Exhaust	5	28.6	292
Associated Utilities, General Area Control, Electrical,			
Mechanical, Etc.	13	52.5	12

Target Handling Facilities. A 20 inch concrete shield has been constructed in front of the target removal area adjacent to the cyclotron. A mechanical hand extending through the shield is used for hot target handling. Observation of the operation is possible through a zinc bromide filled window. This system has been of material aid in reducing the number of over-exposures experienced by the operating crews.

Future plans call for an improved target dolly equipped with a sliding dust cover and a ventilated transfer box. With the installation of this equipment the air borne alpha contamination problem should be lessened. The targets are to be transported from the transfer box to the proposed target handling room in an air tight lead box. Once in the room, the targets will not be exposed to the general atmosphere. All operations will be carried out in a series of dry boxes which are under negative pressure; the exhaust being filtered and expelled to the outside atmosphere through another filter unit and a suitable stack.

Decontamination Facilities. It is often necessary that contaminated equipment from the cyclotron require servicing or modification. In the past, this has been one of the main contributors to the spread of contamination. In order to provide facilities for the decontamination and cleaning of this equipment an enclosed structure sufficiently large to house the liner has been constructed. Air leaks are prevented by completely sealing the structure and placing it under negative pressure with the exhaust air being filtered through a deep bed and CWS

filter paper before being expelled to the atmosphere. Necessary change houses, with locker and shower facilities are an integral part of the structure.

Alignment Dry Box. A similar structure, but large enough to house both the liner and the dees has been constructed in the machine shop area. Thus, facilities are provided for aligning and adjusting the dees as well as facilities for any minor machine work which might be required. The ventilation system is identical to that described for the decontamination area. At present, there are no provisions for a change house because the alpha contamination levels on the equipment to be handled is expected to be low.

Cyclotron Change House. In view of the high levels of air borne alpha and surface contamination in the cyclotron area, a change house is under construction to provide facilities for personnel retaining protective clothing. Two areas will be located; a relatively "cold" area with lockers for clean clothes, and a "hot" area with lockers for contaminated clothes. Between the two areas will be located the shower area containing two units and a wash basin. This shower room will be considered as the edge of the contamination zone. A ventilation system will exhaust into an air duct common to the main cyclotron area air exhaust.

Cyclotron Area Ventilation. A 6,000 CFM blower has been installed to exhaust the air from the cyclotron room. An exit port is located behind the concrete shield facing the cyclotron. Air is exhausted to the outside through a stack located on the fan house roof. Eventually, a filter unit will be installed at the exhaust port.

Plastic Covers. Sealed plastic covers for contaminated equipment have been designed. These will protect any clean areas through which any contaminated equipment must be transported. An immense aid in the contamination control program has thus been provided. Bags of various sizes are kept on hand for small pieces. Larger bags are made as needed. It is planned to use plastic bags for the dees and liner during the reconversion period scheduled for January, 1952. An electronic seamer 1s used to weld the plastic.

Alpha Hand Counters. A revised model of the Chicago Alpha Hand Counter has been installed adjacent to the main entrance of the cyclotron area. A two-fold detecting unit is included and indicates the degree of contamination on a logarithmic count rate meter. Other alpha counters of the Sampson type are located at central points throughout the area.

63" Cyclotron

Work on the 63" cyclotron has progressed steadily in the past several months. The present time schedule indicates that operations should begin about July 1, 1952.

The cyclotron is designed to accelerate triply ionized nitrogen atoms to any energy of 25 MEV. It is expected that the deflected beam current will range between 1.0 and 10.0 microamperes. The cyclotron will be used to study cross sections for such experiments as reactions in gaseous targets. Because of the low energy and small yields, no shielding is planned.

22" Cyclotron

Operation of this cyclotron has presented no radiation hazard to operating personnel because of the low energy of the proton beam. It was designed and is used exclusively for the study of ion sources and deflector and target characteristics.

Van de Graaff Generator

Radiations resulting from the operation of the generator continue to be of only nuisance levels. Routine checks on X-ray production seldom indicates more than 10 mr/hr at a point some ten feet from the ion sources.

As indicated in another section of this report the operating group has been furnished with indicating neutron and X-ray detection instruments which are located close to the radiation sources and provide an alarm whenever tolerance levels, in normally occupied areas, are reached. Radiation warning signs and rope baricades are on hand for use when the radiation levels exceed the MPL.

ANALYTICAL RESEARCH

Polonium in Pump Oil (W. M. Zimmerman)

It has become necessary to develop a method of assaying pump oil for elemental polonium. To accomplish this an attempt was made to prepare an oil with a known polonium concentration so that various methods of analysis could be easily evaluated. Shaking uncontaminated oil with a 6 N HCl solution having a known polonium activity had been suggested as a possible method for "spiking" the oil. 7 The resulting gain of activity by the oil should equal that lost by the acid. This method would have the merit of simplicity, but also, would have the disadvantage that the polonium introduced into the oil would not necessarily be in the same chemical form as the polonium in contaminated oil.

Three attempts were made to "spike" oil by this method. In each case 40 grams of clean Kinney oil and 10 grams of a polonium solution, 6 N HCl, were shaken in a separatory funnel on a serological shaker for 45 minutes. The two phases appeared to be emulsified throughout the shaking period. Following separation of the phases the acid layer was drained and assayed by the evaporation of aliquots on slides which were subsequently counted for alpha activity. No significant amount of polonium appeared in the oil indicating a very unsatisfactory transfer.

The next approach to the problem was to conduct a comparative extraction of the contaminated oil using, in one case, concentrated HCl and, in the other case, concentrated HNO3. Nitric acid oxidized some components of the oil with the result that charred material accumulated at the interface. It was also able to extract a component of the oil which produced a sticky film on the slides. Extraction efficiency was approximately 40% greater when HCl was used and the slides appeared clean and free of film.

Aliquots of a contaminated oil were extracted with HCl of various normalities ranging from 2 to 10 Normal. A 1:1 ratio of oil to acid was used. The liquids were shaken by hand in stoppered centrifuge tubes. The efficiency of the extraction showed no trend and were all of the same order of magnitude. The results are tabulated on the following page.

^{7.} Kochendorfer, Mound Laboratories - Private Communication.

NORMALITY dis./min/ml of o	
HC1	
10	4.0×10^{3}
10	
8	4.9×10^{3}
6	4.3×10^{3}
4	5.0×10^3
2	4.2×10^3

It seems reasonable to assume that the extraction efficiency is relatively insensitive to acid concentration in the range studied. It was arbitrarily decided to use 3.0 N HCl for subsequent extractions since, at this level of acidity, the formation of radio-colloids and the absorption of polonium on glassware should be at a minimum.

An experiment comprised the next phase of this study in which a 45 gram aliquot of contaminated oil was repeatedly extracted with separate portions of 3.0 N HCl. Both oil and acid were weighed directly into a separatory funnel and the system was shaken on a mechanical shaking device for 45 minutes then centrifuged to separate the layers. The complete acid layer was drained and assayed; a second aliquot of acid was introduced into the funnel and the process repeated. Each aliquot of oil was extracted four times. Results of duplicate analyses are tabulated below:

ALIQUOT NO.	ACTIVITY EXTRACTED IN FIRST EXTRACTION dis./min/ml acid	TOTAL ACTIVITY EX- TRACTED IN FOUR EXTRACTIONS dis./min/ml acid	RATIO OF FIRST EXTRACTION TO TOTAL EXTRACTED
1	2.56×10^4	2.90 x 10 ⁴	0.88
2	2.65×10^4	2.90 x 10 ⁴	0.92

In as much as the contribution of the fourth extracted layer was only approximately 1.0% of the total polonium extracted, subsequent extractions would make even smaller contributions. At these lower levels the determination of the fraction extracted becomes difficult since the contribution of equipment contamination and counting background becomes significant.

A one-stage extraction by this method shows promise of giving a good estimation of the total polonium present in an oil sample. To date no additional fractional extractions have been completed, although the results of duplicate single stage extractions have checked within 4%.

Uranium in Urine (D. M. Ross)

One important phase of the health physics program requires the determination of the amount of product level uranium in the urine of exposed employees. Although a method whereby uranium was electroplated directly from a digested urine sample had been in use for two years, constantly changing laboratory personnel, individual short cuts and lax techniques had deprived the analysis of much of its accuracy and reproducibility. It is imperative, therefore, that our basic knowledge of this method be enhanced and necessary improvements introduced if satisfactory results are to be obtained.

At the outset the original procedure, with its discrepancies and inaccuracies, was evaluated in order that the results of the incorporation of new ideas would be more readily evident. Forty-four (44) urine samples, varying in specific gravity from 1.010 to 1.028 were identically "spiked" with one ml of a solution containing 0.01 μ gm of enriched uranium and subsequently analyzed by a standard method containing the following principle steps: (1) Digestion of a 50 ml urine sample with concentrated HNO3, (2) redissolving in water and adding 10 ml of saturated ammonium oxalate, $(NH_4)_2C_2O_4$ containing the ferric ion, (3) electrodeposition of uranium for 50 minutes on a 1.1/8" silver disk using a current density of 0.31 amp/cm², and (4) counting of the silver disk and correction for specific gravity of the original urine specimen.*

From the results it was concluded, first, that the uniform percentage recovery would seem to verify the validity of the specific gravity factors which were in use and, second, since the recovery was consistently low a basic discrepancy involving all samples was

^{*} The original work on this method verified the observation that the recovery of uranium from digested urine was considerably more efficient in those cases where the amount of dissolved solids was low. Inasmuch as the relationship between the specific gravity (as estimation of dissolved solids concentration) and recovery proved to be approximately linear, a factor was determined for each specific gravity which would raise each analysis result to an equivalent 100% recovery. These factors varied from 1.00 for a S.G. of 1.007 to 1.76 for a S.G. of 1.028.

indicated. In the third place the error associated with a single analysis, was greater in the case of the high specific gravity specimens. Table 9 summarizes these findings.

TABLE 9

RECOVERY VS. SPECIFIC GRAVITY (ORIGINAL PROCEDURE)

Specific Gravity	No. of Samples	Average Percent Recovery	Percent Probable Error
1.010	16	55.7	17
1.018	13	57.6	18
1.028	15	56.0	31
Total	44	56.4	22

During the course of a series of exploratory analyses, two factors assumed significance: (1) The silver disks were not being cleaned sufficiently, and (2) the large disproportion of calcium salts in the urine sample rendered impossible the determination of minute quantities of uranium. To correct the first error the silver foil was cleaned with a rouge coated buffing wheel, degreased with trichloroethylene and used immediately in view of the rapid deterioration of a silver surface during even a short exposure to air. Despite the improved recovery resulting from this change it was considered only a temporary expedient until the more convenient electropolishing device can be built. A satisfactory solution to the second factor could not be found so an effort was made to minimize the effect of large calcium and magnesium concentrations. It could be shown that these ions were not a deterrent to the electrodeposition of uranium but rather that, during the course of the 50 minute electroplating, they form a finely divided precipitate which adheres to the surface of the silver disk and seriously inhibits the counting of the plates. The only convenient way to lessen the detrimental effect of these ions was to diminish the size of the urine aliquot from 50 ml to 20 ml, thereby reducing the total salt concentration by a factor of 2.5 and making it unnecessary to include the crude specific gravity factor. Although this expedient did not eliminate the coating on the completed plate it was sufficiently reduced so that only a light brushing with facial tissue was necessary to remove it from the surface.

Following the introduction of these two major innovations and the improvements in general quantitative laboratory technique, the method was again evaluated. On the basis of the analysis results of 55 "spiked" samples as shown in Table 10 it could be shown that (1) despite the elimination of the specific gravity factor no difference existed between specific gravities, (2) the average recovery was 87.6% and (3) the relative probable error on a single determination was 11.0%.

TABLE 10

RECOVERY VS. SPECIFIC GRAVITY (IMPROVED PROCEDURE)

Specific Gravity	No. of Samples	Average Percent Recovery
1.008	7	102
1.014	8	81
1.016	8	92
1.017	8	86
1.020	8	86
1.022	8	82
1.029	8	85
Total	55	87.6

In order that the analysts may be constantly aware of the accuracy and precision of their work it was suggested that control samples be analyzed every morning and afternoon and the recovery efficiently plotted on a three sigma (3 σ) control chart. This chart contains a set of warning limits placed symetrically about the mean at the $\pm 2\sigma$ (standard deviation units) level and a pair of control limits at the $\pm 3\sigma$ level. Any standard sample analysis falling beyond the 3σ limit is a positive indication that the method is out of control and an effort must be made to ascertain the reasons. An analysis result beyond the 2σ limit is only a warning that trouble may be impending. Two out of three or three out of five results lying outside the 2σ limit also indicates lack of control.

Plutonium in Urine (D. M. Ross)

Due to the imminent separation of plutonium isotopes, tentatively scheduled for early 1952, exploratory work on the analysis of plutonium in urine was begun. After surveying the literature for satisfactory methods 8,9,10,11,12 the wet ashing - BiPO4 procedure 13 was selected. In general the method consists of three principle steps:

- 1. The wet ashing of a 24 hour urine specimen with concentrated HNO3. Invariably this requires repeated additions of HNO3 before the last trace of organic matter has been digested. The residual salts are dissolved in dilute HNO3.
- 2. The addition of the Bi ion and its subsequent precipitation as BiPO₄. A one hour digestion at 75°C was required to insure the complete co-precipitation of the plutonium.
- 3. After redissolving the ${\rm BiPO_4}$ in dilute ${\rm HNO_3}$ the plutonium was co-precipitated with lanthanum by the use of 0.25 mg of the lanthanum ion. This precipitate was stirred and the liquid evaporated on a stainless steel disk.

Although straightforward in design, this procedure requires a near flawless quantitative technique. Suitable recoveries of more than 90% could not be obtained until after several weeks of attentive practice. Beginning with the third step each reaction was analyzed separately until precision and accuracy were readily obtainable.

Polonium in Urine (D. M. Ross, W. M. Zimmerman)

The necessity for the routine urmalysis for polonium arose during this period. At the outset, the method employed by Mound Laboratory 14 was considered and eventually installed. Briefly, the

- 8. Healy, J. W., "Bioassay at Hanford," HW-10522, July 20, 1948.
- 9. Langham, Wright H., "Determination of Plutonium in Human Urine," MDDC-1555, August 14, 1947.
- 10. Russell, E. R., "Procedures for the Detection of Plutonium in Urine, "MUC-ERR-156, October 20, 1945.
- 11. Russell, E. R., "Distribution and Excretion of Plutonium," N-1536 pl. June 11, 1946.
- 12. Koshland, M. E., "Procedure for Determination of Plutonium in Urine," MonN-92, May 21, 1946.
- 13. Shubert, Jack, Argonne National Laboratory, Private Communi-
- 14. Spoerl, E. S., "Urine Assay Procedure at Mound Laboratory," MLM-460, April 14, 1950.

procedure involved the deposition method wherein the polonium is collected on the surface of a copper disk by electrochemical displacement. Fifty ml of the urine solution are transferred to a waxed paper cup, brought to an acid normality of 1.0 in HCl, stirred for a two hour period at room temperature. The plated copper disk is removed, dried and counted on both sides. Evaluation of the method easily verified the reported recovery of approximately 85%. However, despite the simplicity of this approach, the necessity for counting both sides of the copper disk proved to be a formidable disadvantage. To circumvent the problem of dual counting, J. Rundo of Harwell¹⁵ preferred to use a silver disk in a specially heated plating bath very similar to that employed by McAuliffe¹⁶ for electroplating uranium. Harwell's reported recovery was excellent but, inasmuch as silver is difficult to clean adequately, copper foil was chosen for insertion in the electroplating cells.

Each of twenty-four 50 ml blank urine specimens were "spiked" with one ml of polonium solution known to count 7.4 c/min/ml, made to 1.0 normal acidity with concentrated HCl, placed in the plastic electroplating cell with a clean copper foil 1 1/8" in diameter, and, with the surrounding water bath raised to 80°C, stirred for two hours. The average of a number of one hour alpha counts, as measured in the Nuclear Measurement Corporation PC-2 proportional counters, indicated a remarkable recovery of 101%. Here is a method which can afford quantitative recovery and require but a single count per disk. It would appear to offer a distinct advantage over the Mound Laboratory procedure where a limited number of analyses are desired although a huge work load would require more space and equipment than is feasible.

Rundo, J., "The Analysis of Biological Samples of Polonium," AERE HP/R 627, December 1950.

^{16.} McAuliffe, Clayton, "Quantitative Electroplating of Uranium for Isotopic Analyses, "A-3626, February 27, 1946.

SPECIAL PROBLEMS

Estimation of Personnel Exposure Following Po - Be Spill (D. M. Ross)

There was recorded in a previous report¹⁷ the rupture of a Po - Be neutron source which resulted in an exposure to insoluble polonium dust by D. F. C. Herein is discussed the results of the physiological tests which were conducted to determine the degree of exposure experienced by D. F. C.

An activity of 15,000 dis./min was detected on a nose swab obtained from him thereby virtually certifying that a polonium exposure had been experienced. Immediately there was set into motion a series of tests which would evaluate the degree of exposure. These included: (1) daily polonium urinalysis, (2) daily hemotological tests, and (3) daily fecal analysis.

Urinalysis for polonium was accomplished without need of digestion. A 50 ml sample was made 0.5 N in HCl and plated directly in the manner indicated below:

Plating of polonium from an acid solution, universally accepted as the most satisfactory method for the isolation of minute quantities of the metal, was used during the course of these analyses. All solutions were 0.5 N in HCl, placed in a fluorothene plastic plating cell in the presence of a 0.003" silver disk, heated to 70°-90°C, and plated, with constant stirring, for two hours. The silver foil, on which the polonium was plated, was washed, dried and counted in a Nuclear Measurement Corporation PCC-10 proportional counter.

Digestion of feces was accomplished by the method developed by Fink, ¹⁸ which utilized a mixture of concentrated nitric and perchloric acids. Since the evolution of copious quantities of nitrogen oxides, occurring during the course of the digestion, dictated the use of a small sample of 50 grams or less, extreme care was taken to insure the use of an aliquot that was representative of the entire sample. A known weight of feces was stirred with a known volume of concentrated HCl until the resultant mixture was homogeneous after which a suitable aliquot was removed. The procedure was continued in the following manner:

^{17.} Struxness, E.G., "Health-Physics Progress Report," Y-836, Dec. 1951.

^{18.} Fink, Robert M., Biological Studies with Polonium, Radium and Plutonium, Vol. 3, 1950.

To the aliquot in an 800 ml Kjeldahl flask was added 70% perchloric acid and concentrated nitric acid in the ratio of 3 ml perchloric to one ml per gram of sample. The digestion proceeded during successive immersions in a boiling water bath and a hot air bath. It was essential that excessive heating be prevented in the upper part of the flask in view of the occasional violent action initiated at the water line within the flask. This comparative safety was accomplished through the use of a piece of asbestos paper with a 1 inch diameter hole cut through its center placed between the burner and the flask. Heating on the air bath was continued until the solution appeared water white (or pale yellow if iron were present) and perchloric acid fumes filled the flask. After cooling, the solution was neutralized with NaOH and prepared for plating by making 0.5 N in HCl.

The fecal analysis results, shown in Figure 9, afford the best estimation of the degree of severity of exposure to which D. F. C. was subjected.

During the first five days following the accident 8800 dis./min This can be considered that maof Po alpha activity was excreted. terial which, being large in particle size, did not reach the lung or, if it did so, was rapidly rejected. Since this was a single exposure and not a continuous one, it was considered logical that this quantity of Po would reach a maximum and subsequently diminish. During the succeeding twelve days the excretion of Po leveled off and remained relatively constant. True, there were one or two wide deviations but these were invariably occasioned by extremely wide variation in sample size. It is believed that this period is characterized by the rejection from the lung of material of considerably smaller particle size, which, having reached the bronchials was now being rejected by the undulatory action of the cilia. The results of the weekly samples thereafter indicate the gradual, though not complete, depletion of polonium in the lung.

How much polonium was absorbed? On the basis of our urinalyses and blood work it can be said that no detectable amount of polonium was absorbed into the blood stream.

The results of the analyses appeared unusual to those who regularly perform polonium excretion tests in that at no time was polonium detected in the urine while comparatively large amounts appeared in the feces. Inasmuch as urine tests were routine at installations where polonium was frequently handled, it was felt that our method or technique

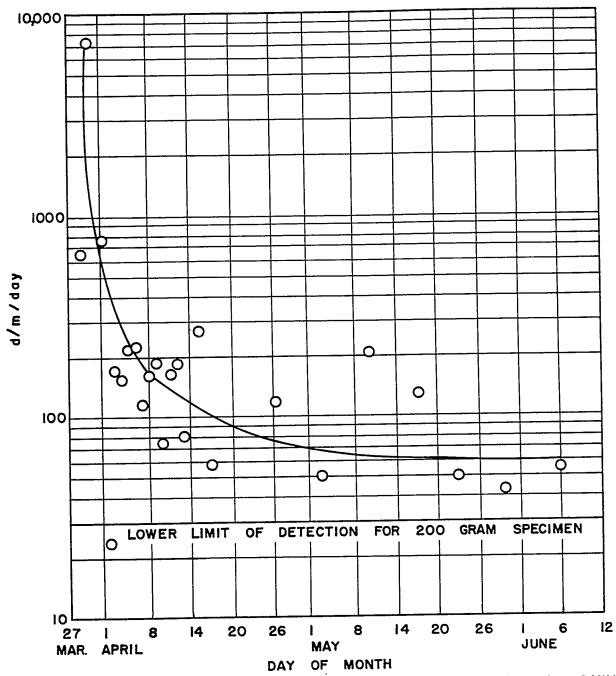


FIGURE 9. DAILY FECAL ANALYSIS FOLLOWING POLONIUM EXPOSURE

was at fault. However, a comprehensive review of the literature revealed our procedure to be identical with the accepted method. An answer was not available until Mr. W. P. Jolley of the Biology Division of the Mound Laboratory, Miamisburg, Ohio visited our department to ascertain the degree of confidence which could be placed in our analyses. Mr. Jolly's report on his findings is quoted verbatim in the Appendix to this report. In addition to approving our analytical methods he offered the solution that the early feces analyses would be similar to a measurement of excretion from a gavage dose. * If this were true, and 4% (294 dis./min) of the 7,367 dis./min of polonium were absorbed, it would be expected that only 0.1% of this absorbed Po would show up in a 24 hour urine specimen. Or the highest urine sample result should be 0.294 dis./min of polonium per 24 hour sample. Obviously, this is not a detectable amount.

Being desirous of detecting any possible indication of exposure, daily blood tests were performed by laboratory technicians in the Health Physics Department. Stringent analysis of four of these samples failed to reveal any significant changes in the blood picture which could conceivably be attributed to the polonium exposure. A memorandum by R. E. Zipf, M.D. is included in the Appendix to this report which gives the results of the complete study of the four blood smears.

In summation it can be said that D. F. C. received a polonium exposure below the minimum required to produce physiological changes.

Theoretical Studies on Uranium Radiation (E.C. Long)

Dosage Calculations. During the past two and one half years, calibrations of personnel monitoring film to beta rays has been accomplished by placing the film meter in contact with a slab of normal uranium. The surface dosage, taken as 240 mrep/hr, ** is based on a number of measured values found in the literature. Calculated values of surface beta dosage found in the literature are usually higher than measured values.

^{*} Gavage Dose - A dose introduced directly into the stomach and permitted to follow the normal digestive procedure from that point.

^{**} mrep - milliroentgen equivalent physical - That amount of any radiation from which tissue will absorb 0.083 ergs of energy.

Specialized monitoring of uranium in a variety of shapes and geometries has created a need for more information about beta surface dosage as well as other radiation dosages. Work, therefore, was undertaken on such calculations and measurements of radiation sources, with the study initially being of calculations as found in a number of documents and texts. Project Handbook Cl-697 was found very useful and used almost exclusively.

Two examples of calculations made for beta dosage using the Project Handbook methods are: (1) From an infinite slab of normal uranium, in equilibrium with daughter products, the beta dosage is 280 mrep/hr. This agrees with other values found. (2) From an enhanced uranium slab, in equilibrium with daughter products with isotopic content of 5.6% U-238, 93.3% U-235 and 1.1% U-234, similar calculations delivered a surface dosage of 156 mrep/hr. The equation for these calculations is:

$$E_a = \frac{\mu S_v}{2 \nu} \left[F_1 \left(\Sigma \sigma t \right) - F_1 \left(\Sigma \sigma t + \nu h \right) \right]$$
 (1)

Where:

 E_a is power dissipated per unit volume: μ and ν are coefficients of absorption of receiver and slab respectively; and S_{ν} is number of emanations per unit mass (or unit volume) per unit time. The absorption coefficients of intervening substances of thickness, t_1 , t_2 , etc., separating the radiator and receiver are, σ_1 , σ_2 , etc., and the thickness of the radiator is h.

$$F_1 (b) = \int_0^{\pi/2} e^{-b \sec \theta} \sin \theta d\theta \qquad (2)$$

which may be graphically integrated. For a slab, equation (1) may be simplified by the following steps:

$$\lim_{t \to 0} \left[F_i \left(\Sigma \sigma t \right) \right] = 1 \tag{3}$$

and
$$f_1 \left(\sum \tau t + \nu h \right) < 0.001$$

 $vh > 5$ (4)

$$\therefore E_a = \frac{\mu S_v}{2 \nu}$$
 (5)

By making certain assumptions and approximations, an equation is easily obtained for the theoretical beta surface dosage from uranium of any isotopic content,

$$D(mrep/hr) = 280.6a + 150.9b,$$
 (6)

Here a and b are isotopic ratios of U 238 and U 235 respectively; U 234 not adding to the beta content.

The dosage-shielding equation for radiation at the center of a hollow sphere, Figure 10 is:

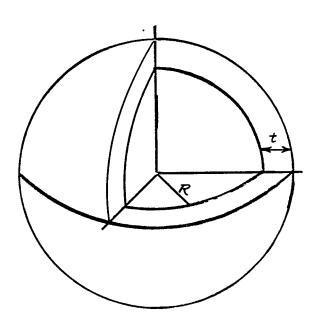


Figure 10. Radiation at center of a Shperical shell with concentric absorbers (absorbers not shown).

$$E_a = \frac{\mu S_v}{\nu} \quad \epsilon^{-B} (1 - \epsilon^{-\nu h}). \tag{7}$$

In this equation, B is $(\Sigma \sigma t)$, and h is the thickness of the shell.

For a hollow sphere with a circular opening, Figure 11,

$$E_{a} = \frac{\mu S_{v}}{\nu} \quad \epsilon^{-B} (1 - \epsilon^{-\gamma t}) (1/2 + \frac{\cos \alpha}{2})$$
 (8)

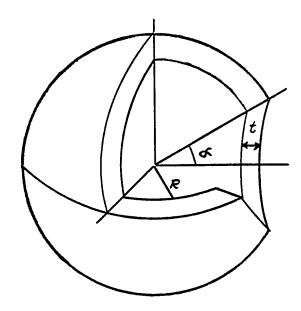


Figure 11. Radiation at the center of a spherical shell with concentric absorbers (absorbers not shown) and a circular opening.

Calculations have also been initiated for dosage on the inner surface of a hollow sphere with opening and for hollow tight truncated cones on center axis of cone, but these have not been completed.

The Instrument Development Group is presently engaged in fabricating an air-wall ionization chamber for direct measurement of beta dosage, using a small chamber and a vibrating reed electrometer. Some success has been realized in chamber design and operation, but not enough data is available at this time.

Counting Room Techniques (J. R. Muir)

This period was one of experimentation and transition in the counting laboratory. It involved changes in physical structure, methodology, and personnel. Work in the counting laboratory was divided into two major divisions: I. Dust Sample Counting and II. Urine Sample Counting.

I. Dust Sample Counting

Dust samples consist of air samples taken by Gast air samplers using Whatman #44 filter papers and smears taken on Whatman #50 paper. Samples are counted in 6 Kelly-Koett scalers with an NMC PCC-10 proportional counter converter attached to each. In order to determine the background and efficiency of the counters the following method is used:

1. Background

The piston of the converter chamber is wiped clean with facial tissue and the background of the empty chamber, under a normal flow of argon gas, is counted for approximately 10 hours over night. Background is determined at the beginning of the day shift and is expressed in terms of counts per minute. Maximum permissible background has been set at 0.9 c/min. Counters which exceed this figure are decontaminated by the instrument department without removal from the laboratory.

2. Efficiency

Counter efficiency is determined by counting an alpha standard. The standard is counted five times in succession in each counter for a total of 3200 counts per counter. Operating efficiency of the counter is determined by dividing total counts by total time and dividing the result by the value of the standard (expressed in disintegrations per minute). An average counter efficiency is approximately 51%.

3. Sample Counting

Dust samples are never counted for less than two minutes but low activity samples are counted approximately ten minutes. The autocount feature of the scalers is used and is set to stop the counting when a total of 160 counts is reached. If the total is obtained before the two minutes have elapsed a recount is taken covering the two minute minimum.

II. Urine Sample Counting

Urine samples consist of several material types which have been electroplated on silver or copper disks or which have been evaporated on stainless steel or nickel disks. Samples may be contained in media

other than urine, such as: feces, oil or water. Counting is done in eleven NMC PC-2A low background proportional counters, and 3 Kelly-Koett scalers. The following method is used to determine background and efficiency:

1. Background

Background is taken in the same manner as that set forth in the section on dust sample counting with the exception that a time factor of exactly 10 hours is used and the resulting background is expressed in terms of counts per hour. Maximum permissible background has been set at 10 counts per hour. Contamination problems have been very slight and the average background is much lower.

2. Efficiency

Efficiency is determined by counting an alpha standard. One is available for each counter. A pre-set time of five minutes is used. Calculations are performed in the same manner as that for dust samples. The average efficiency of these counters is approximately 50%.

3. Sample Counting

Urine samples, et al., are counted for exactly one hour and the results are expressed in counts per hour. Longer counting times from 2 to 10 hours are used on special request for a small number of extremely low-level samples.

Stack Sampling and Particle Size Studies (C. M. West, W. H. Baumann and A. L. Conte)

Near the end of this period a study of uranium losses through stacks and ducts was instigated. An iso-kinetic sampler modeled after the one described by a Harvard University group ¹⁹ was designed and built. It is hoped that this study will reveal some information on air cleaner effectiveness.

The iso-kinetic tube is equipped with four tips of various size openings as well as four thin plate orifices to simplify the problem of adjusting the manometer to suit the duct pressure. Tests in

^{19.} Hervard University School of Public Health, Final Progress Report, NYO 152.

ducts ranging from six to thirty-six inches can be made by using the adjustments. The tube is graduated in inches to facilitate the traverse across the stack. A tapered bushing and the tapered shank of the tip of the filter paper thimble are used to lock the thimble in place.

Two stages of a cascade impactor shown in Figure 12 were machined from plexiglas for the purpose of visually studying the jet action on the impactor. This has not been tested as yet. A dust chamber for the calibration of impactors is also being designed. This chamber will be equipped with a ballmill, adjustable fans for the even distribution of the dust, and apparatus for removing the dust from the chamber. A more detailed report will appear in a future progress report.

Filter Paper Evaluation (W. H. Baumann)

Whatman filter papers #42 and #44 are employed in conjunction with standardized field sampling equipment to collect particulate contamination resulting from operations and processes carried on within the Y-12 Plant for the purpose of evaluating health hazards. The papers have high collection efficiency (low penetration) and high resistance. The former renders the papers highly suitable for air sampling, however, the latter quality is undersirable since it may be the limiting factor in determining the amount of air that may be aspirated for sampling. For this reason, some preliminary work on filter paper evaluation was undertaken to find a more suitable filter paper.

The Chemical Warfare Standard D.O.P. (di-octyl phthalate) apparatus was used with certain modifications to check the papers. In any procedure for evaluating filter media, the characteristics of the test aerosol must be well established, and since there is no "standard" test aerosol the evaluation will be only as complete as the limitations imposed by the aerosol. Our selection of D.O.P. was purely arbitrary since the equipment was available for testing. Furthermore, the results are reproducible and will indicate the _performance of filters against small diameter particles. In hazard evaluation, papers should be checked against initial penetration since neither sufficient time nor particle concentration may be available in the field to allow filters to "plug" to improve their performance. Papers were checked at various air velocities employing the monodisperse liquid aerosol. The apparatus was operat-

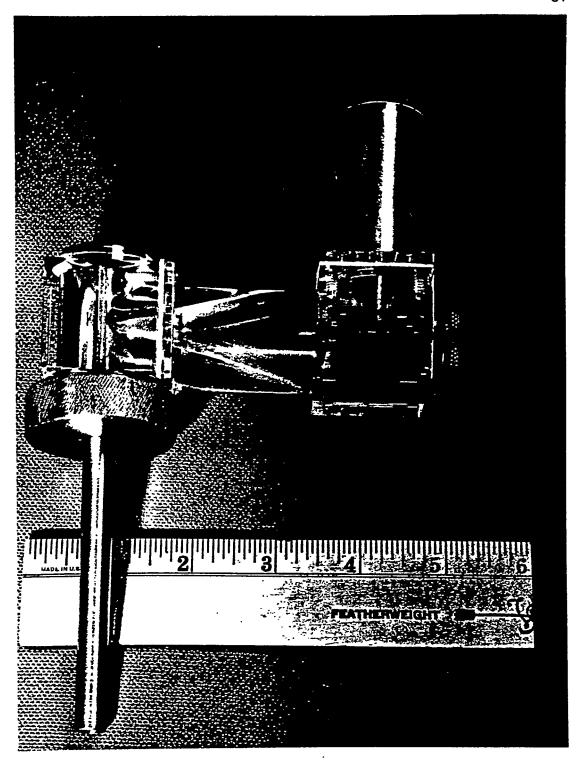


FIGURE 12. TWO-STAGE CASCADE IMPACTOR

ed to give a particle size of 0.3 μ diameter and the N.R.L. Penetrometer, connected to a Brown Continuous Recorder, was used to measure percentage of penetration. A concise summary of findings is presented in Table 11.

TABLE 11

	Filter Velocity, fpm	Penetration %	Resistance inches of Hg.
Type Paper Whatman #44	60	0.03	4.95 10.08
wnauman 1144	100 130 150	0.01 0.02 0.003	14.17 18.11
Whatman #42	60	0.02	9.84
	90	0.003	22.83
Whatman #50	60	0.000	23.62
Whatman #41	70	28.0	0.59
	100	18.0	0.83
	150	7.0	1.46
	200	3.0	2.17
	230	2.0	2.56
H & V #70	70	0.30	1.46
	100	0.25	1.81
	150	0.02	2.99
	200	0.003	4.06
	225	0.002	4.33
Polyfiber	70	74.0	0.04
	150	82.0	0.16
	240	73.0	0.28

The results show that Whatman paper #44, #42 and #50 have excellent particle retention but excessive resistance properties at filtering velocities in excess of 60 feet per minute (fpm). Whatman #41 has poor particle retention at low filtering velocity which improves markedly as velocity is increased. Resistance to air flow with this paper is low throughout the velocity range investigated. Hollingsworth and Voss (H. & V.) #70 appears to offer high collection efficiency with reasonably low resistance over the range studied. Polyfiber, a polystyrene plastic,

was loaned to us by the Chemical Warfare Service and it was found to have poor particle retention and negligible resistance to air flow. However, this material is soluble to many organic solvents which might enhance its adaptability to air sampling provided it could be used in a velocity range which makes its collection efficiency sufficiently high to justify its use.

Collection efficiency and air flow characteristics are not the sole criteria of filter media used in hazard evaluation. At our plant, filter media absorption of alpha emitting contaminants is exceedingly important as well as dry properties preparatory to spectrographic analysis. H. & V. #70 paper appears to be the filter paper most adaptable for our over-all program for air sampling of radioactive contaminants. Whatman #41 paper has the best characteristics for non-radioactive contaminants.

Experiments on Filter Paper (E. B. Pflasterer)

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A desire to know the actual concentration of alpha particulate matter in air has led to an investigation of the possibility of constructing an air monitor the output of which would indicate directly the concentration in terms of disintegration per minute per cubic meter of air. In an ideal machine of the type under consideration, the dust deposit from each cubic meter of air drawn through a filter paper tape would constitute a sample. This sample when counted would then indicate the amount of alpha active material present in terms of disintegrations per minute per cubic meter of air.

Plainly, in such an instrument, the controlling factor would be the air flow rate. One would like to be certain that each sample was drawn from a cubic meter of air. Two means of metering the air were considered: one involved the use of a rotameter, the other a dry test meter. The use of the rotameter was first considered. Considerable thought was given to an attempt to devise some type of compensating mechanism which would insure metering a given volume of air in a certain time interval. To this end, a number of experiments on filter papers were carried out in order to get an indication of the range over which any controls which might be devised to compensate for pressure and temperature changes would have to operate.

Although, as it turned out, the tests on the filter papers were not particularly helpful on this project, the results of the tests are presented here for their own interest. Filter papers of various kinds are widely used for the collection of dust samples, but there is almost no information available on their performance characteristics.

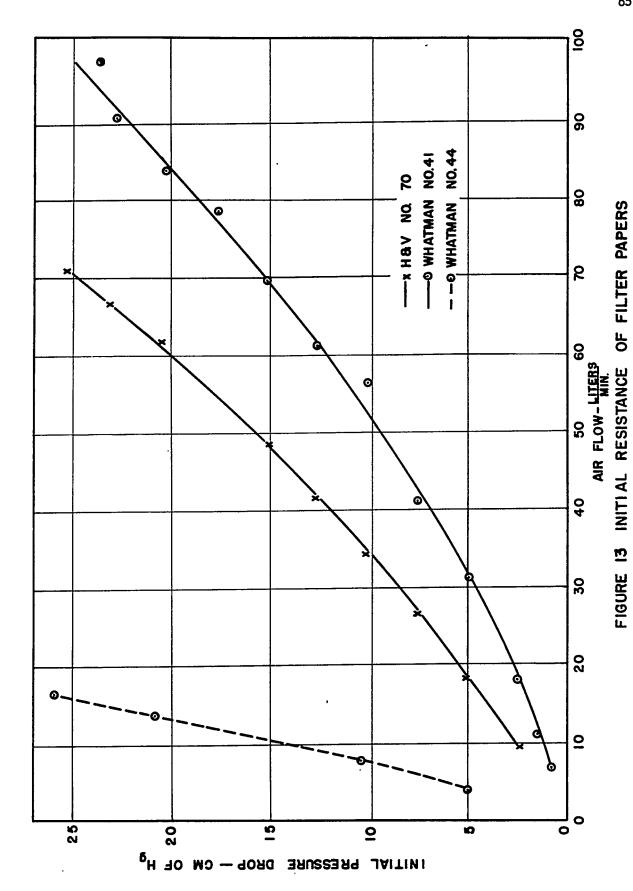
The experiments which the accompanying curves illustrate were carried out using a dry test meter with a 10 liter dial, a mercury manometer and a Roots - Connersville Blower Type AF size #22.

Figure 13 shows the air flow rates attainable and the initial pressure drops on the down stream side of three filter papers. The sampling area was a circle one inch in diameter. A test was also run on Whatman #42 paper. The maximum flow rate attainable was about eight liters per minute. With both the #42 and #44 papers the pump would not operate more than two minutes before overloading the motor and causing it to open the circuit breaker. For H. & V. #70 paper the maximum flow rate was about 70 liters per minute, and for Whatman #41 paper the maximum was about 95 liters per minute. The abscissa is shown in terms of liters per minute. No attempt was made to measure the velocity of the air stream, since, in practice, one is interested primarily in the volume of air sampled.

Figures 14 and 15 give an indication of the manner in which flow rate and pressure drop (over and above the initial pressure drop due to the resistance of the paper) vary with the loading of a filter paper. Figure 14 is for H. & V. #70 paper and Figure 15 is for Whatman #41 paper. These data were taken with the pump working at its maximum capacity. The papers were loaded with titanium tetrachloride smoke, the amount of smoke deposited being determined by weighing. For both papers the flow rate decreased faster than the pressure drop increased. The Whatman paper has a load range almost twice as great as the H. & V. paper under the given conditions, but it is not known how the two papers would compare for the same initial flow rate.

Gas Control Unit for Proportional Counters (E. B. Pflasterer)

Nine model K-263 Kelly-Koett Scalers which had formerly been used with parallel plate chambers had been modified for use with the model PCC-10 Proportional counter converter manufactured by the Nuclear Measurements Corporation. During a re-evaluation of counting room procedures and techniques it was noticed that a considerable variation in the counting rate of dust samples collected on filter paper could be obtained by altering the flow and flushing rates of argon gas to the counting chambers. Experiments further indicated that it is nearly impossible to manually adjust a gas control valve in order to get a uniform flow and flushing rate from sample to sample. Moreover, tests indicate that dust samples collected on filter paper should be flushed for at least two minutes prior to counting.



In order to standardize the flow rate, the flushing rate, and the flushing time, the simple device shown in Figure 16 was designed. The unit utilizes a solenoid valve with a controlled leak, a time delay relay, and a latching relay with an electrical reset coil. The flushing period is initiated by momentarily closing the push button switch. This action closes and locks the main relay contacts, energizes the solenoid valve and the heater of the time delay relay. At the end of the flushing period the contact on the delay relay closes energizing the reset coil on the main relay and thereby allowing the solenoid valve to close to its normal position.

At this time four of the nine units which have been ordered have been built and installed. Operation of the units have proved very satisfactory.

Source Holder and Shield for Radium Needles (E. B. Pflasterer)

Since a sufficiently large number of needles containing approximately one milligram amounts of radium are in use throughout the plant area for the checking of process monitors and other instruments, it was thought wise to settle on a standard means of storing and handling them. Details of the design adopted are shown in Figure 17. The shield and storage container consists of a small cylinder of lead molded around a threaded brass insert. The source holder is a lucite rod having a cavity at one end in which the radium needle is placed. A threaded lucite plug seals the needle in the rod while a threaded brass sleeve, fixed to the lucite rod with a pin, is used to screw the holder into the shield for storage. The dosage rate at the handle end of the lucite rod is less than 7.5 mr/hr, whereas the rate at the surface of the shield is of the order of 25 mr/hr.

Neutron Monitor at the 5 MEV Van de Graaff Generator (E. B. Pflasterer)

A request was received from the group operating the Van de Graaff for a neutron monitor. Since speed was essential, a monitor was assembled out of components that were immediately available. The monitor incorporates a Hurst "proportional to dose" chamber, a linear amplifier, and an old process monitor with an alarm. After the monitor was assembled, Mr. G. S. Hurst of the Health Physics Division, Oak Ridge National Laboratory, designer of the chamber, supervised its calibration. It is intended that this installation be only temporary to be replaced with a neutron monitor comparable with the one described in ORNL-590.

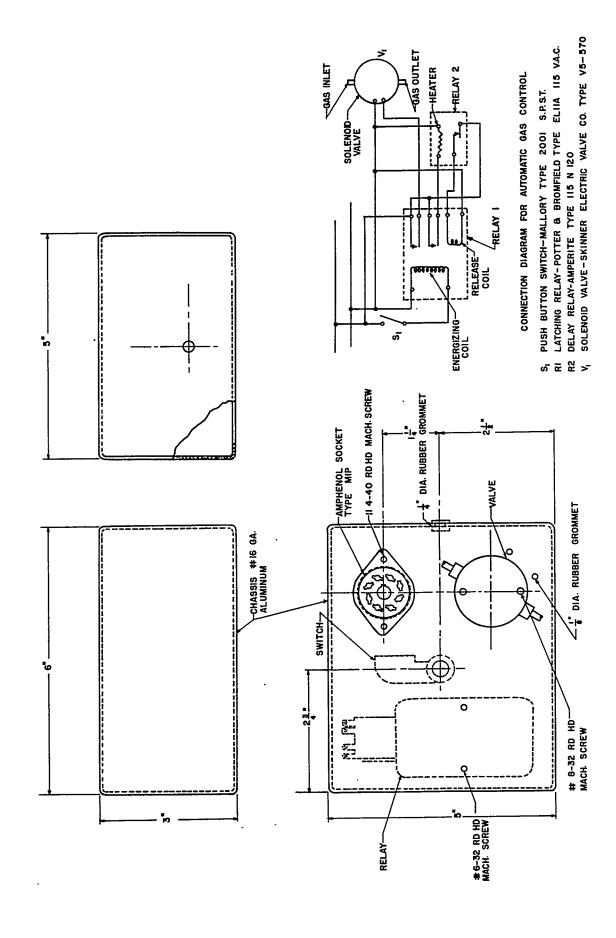


FIGURE IG HEALTH-PHYSICS AUTOMATIC GAS CONTROL UNIT

Other Work in Progress (E. B. Pflasterer)

At the request of Mr. D. M. Ross, methods were explored for electrolytically polishing nickel disks for use in urine plating cells. A suitable electrolyte, containing phosphoric and sulfuric acids, was found. Current densities and required times of polishing have been established for several methods of handling the disks. Further work on this project awaits a decision concerning which of the several methods is most appropriate for our needs.

Performance requirements and tentative specifications for the alpha particle air monitor alluded to in the section on filter papers have been submitted to the Instrument Development Group for feasibility studies.

The circuit modifications necessary to reduce the resolution loss and improve the high voltage regulation of the Kelly-Koett Scalers in use with the proportional counter converters have been decided upon. Instructions for the modification have been prepared, and a work order has been issued, but further work on this project awaits the arrival of parts that are not available from plant stores.

Three portable alpha survey instruments of the type described in ORNL-602 are being built in our shops from drawings furnished by Mr. D. M. Davis of the Oak Ridge National Laboratory.

An experimental scintillation counter for dust samples on filter paper is nearing completion. This instrument and its performance will be described in detail in a future report. The answer to their second question "Were their analytical procedures correct?" I could suggest only that they stir their plating solutions with glass stirring rods rather than platinum ones, and that it wasn't necessary to heat the solutions while plating.

Dr. Zipf examined four of D. F. C. 's blood smears, as well as his hematological record, all of which I brought back from Oak Ridge. His report is attached to this memorandum.

Mr. E. G. Struxness of the Health Physics Group at Y-12 was interested in polonium autoradiographs of blood smears, these we have reported with photomicrographs in Quarterly Report Biology Research, MLM-471-2, page 135, July 1, 1950. Messrs. D. M. Ross and R. Pletz of the same group were interested in Mound Laboratory Final Report - Urine Assay Procedure at the Mound Laboratory, MLM-460, which they understood had been recalled from the Oak Ridge Area. Since returning, I have checked this matter with Central Files, this report was recalled, but has been reissued and should be available to them through their original source.

From all information made available to me during the above mentioned trip, I believe that D. F. C. received a polonium exposure far below our minimal acceptable level. I further believe it would be a great advantage to the Health Physics Group at Y-12 if they could receive our reports.



SECURIT

Slide #1. Smears revealed good distribution. There was moderate hypochromia with a few ovalocytes seen. There is a solitary nucleated red blood cell seen. There is a percentage increase in the lymphocytes for the most part in the intermediate level. Many of the nuclei of the lymphocytes are lobed. Platelet distribution is apparently normal.

Slide #2. Smear revealed good distribution. There is evidence both of macro and microcytes. The red cells have the appearance of being hypochromic. There is a relative and absolute lymphocytosis with an absolute neutropenia. Platelet distribution is apparently normal.

Slide #3. Smear is essentially similar to #2. Platelet distribution is more sparse, suggesting a reduction in the platelet count. The monocytes seen are vacuolated and contain a few toxic granules.

Slide #4. The smear is well prepared. The red blood cells appear normal in character. There is a return of the hemogram to a more normal appearance. There is a return to equilibrium of the granulocytic ratio with still a preponderance of intermediate lymphocytes. The monocytes retain the vacuolization of the cytoplasm and the toxic granules.

IMPRESSION

The smears as presented suggest a lymphocytosis with morphological alteration of the mononuclear cells. This type of lymphocytic picture is often seen in lymph node stimulation, the most likely being that of a viral infection. The return to normal values suggests gradual recovery. The reduced platelet count suggests bone marrow depression of one type or another. Although there is evidence of bone marrow depression this should not be interpreted to be due to activity. This patient should be further evaluated to determine the actual etiology of this altered hematological report. It is suggested that in the future, reticulocyte counts be run on suspected polonium exposed persons, as our recent animal experiments indicate an early depression of these cells.

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Safety

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A Division of Union Carbide and Carbon Corporation
Y-12 PLANT

Contract No. W-7405-eng-26

HEALTH PHYSICS PROGRESS REPORT

January 1, 1952 to July 1, 1952

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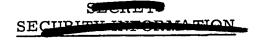
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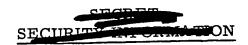
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INTRODUCTION

H. F. Ballenger

New Facilities

Construction of the new health physics facilities is well under way. Since a former production building will be used to house the department, it was necessary to strip the building of existing equipment and to decontaminate as required before the actual construction could begin.

Actual construction of the laboratories has started. The walls of the counting rooms and the instrument shop have been completed, and service piping has been installed in both the high and low level laboratories. The expected completion date, September 15, 1952, has been postponed because of the delay in receiving furniture and other necessary equipment.

Visitors

Dr. W. D. Claus, Chief of the Biophysics Branch of the Office of Biology and Medicine, visited the Health Physics Department in May. Discussions were held on external and internal limits, the cyclotron, and the transfer of twenty-one employees from Area B, 9212 -enriched (See Internal Uranium Exposures, this report).

Another visitor was Dr. Katherine Williams, Principal Medical Officer to the Atomic Energy Research Establishment at Harwell, England. Suggested solutions to mutual problems on beryllium control, laboratory design, and excretion analysis were discussed. Tours were conducted through the Beryllium Machine Shop, Health Physics Bio-assay Laboratories, and the Beryllium Analytical Laboratory.

Dr. Leslie Silverman of the Harvard School of Public Health came in April, at the request of the Health Physics Department, to lend valuable assistance in the solution of problems concerning hood design and ventilation studies in Building 9212.

Dr. Robert A. Kehoe of the Kettering Laboratory, University of Cincinnati, delivered an informal lecture on the toxicology of mercury before

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SECURITY INFORMATION

a group of engineers, chemists, and physicians. His presence was sponsored by the Medical and Health Physics Departments.

Personnel representing the Health Physics Department visited the Kettering Laboratory at Cincinnati, the University of Rochester, and Washington, D. C. One member went to the Nevada Test Site to participate in a six-week program on the fall-out of contaminants which was conducted by the UCLA Atomic Energy Project.

Orientation and Training

All of the training activities described in detail in the previous report (Y-858) were functioning at some time during this report period.

Again, the department, in cooperation with the Health Physics Division of the Oak Ridge National Laboratory, provided a period of industrial plant experience for the AEC Fellows in Radiological Physics. Ten units, consisting of two members each, were directed in a one-week program during which each person was permitted to observe or participate in the activities of this department.

Following an introductory talk describing the principal work carried on in the Y-12 Plant and the major problems concerning health physics, presentations on current studies and problems in the following subject categories were made: survey instruments and personnel meters, airsampling instruments and problems, radon and thoron decay calculations applying to air activity studies, cascade impactor studies, neutron film and autoradiographic studies, urinalysis procedures for various alphaemitting elements, and observation of research accelerator facilities.

Twelve key personnel from other departments and trainee representatives from other AEC installations were trained similarly in the work and techniques of this department. Time was conserved by arranging for them to participate in the program in conjunction with the Fellows.

INDUSTRIAL HYGIENE

W. H. Baumann and M. B. Long

Air Sampling

Routine air sampling is still being carried on at all beryllium and mercury handling operations. Other atmospheric contaminants are investigated as conditions indicate.

Air analysis data show that control measures are very effective where beryllium and its compounds are handled. Mercury contamination is fairly well controlled, although housekeeping practices are relaxed at times, thus giving rise to excessive concentrations of mercury vapor in air. A summary of all air-sampling data covering this report period is presented in Table 1.

Hood Design

In an effort to reduce uranium contamination arising from machining operations, an evaluation program of hood design and performance was planned. The problem was simplified, somewhat, because the operations involved just two types of lathes. Hence, the hood design could be standardized. Experimental hoods were installed on several machines, and air analysis data were collected. After final approval by the Chemical Division and the Health Physics Department, the hoods will be fabricated and installed on all machines.

The various hoods which have been tested are shown in Fig. 1. The final design has been fixed on Type 3 in Fig. 1 for use with the larger lathe; and Type 6, with the smaller machine.

Stack Sampling

In connection with the proposed installation of hoods, the need for air cleaning had to be determined since the original exhaust ventilating systems were not equipped with dust filters. It was expected that the uranium concentration in exhaust ducts would increase with the installation of localized ventilation and that air cleaning would be important both from the standpoint of recovery and air pollution.

TABLE I

INDUSTRIAL HYGIENE AIR SAMPLING DATA

Contaminant	Number of General Air Samples	Number of Operational and Breathing Zone Samples	Number of General Air Samples Exceeding MPL	Number of Operational and Breathing Zone Samples Exceeding MPL
Beryllium	1540	206	2	12
Mercury	41	1199	8	195
Ammonia	17	15	0	5
Lead	5	10	0	0
Carbon Tetra- chloride	0	26	0	0
Нехопе	14	16	0	0
Ether	4	5	0	0
Acetylene	0	6	0	0

The first hood (Type 5, Fig. 1) installed on a small lathe used for a polishing operation incorporated a chamber in which fiber filters were inserted. When samples were taken with an isokinetic sampler in the branch duct, the individual fiber filters were found to be neither practical nor economical.

At this time, Dr. Leslie Silverman (See <u>Introduction</u>) was consulted for advice in the selection of air cleaning equipment. He recommended that chip traps be substituted for the fiber filters and also that all exhaust ventilating systems handling normal uranium be connected to a central air cleaner of high collection efficiency.

Dust concentrations which passed through the ventilation duct from the larger lathe, operating at low spindle speeds, were of the order of 0.002-0.04 grains per 1000 cubic feet (gr/1000 ft³). The installation of the chip trap did not change this concentration. In addition to the unfavorable location of the initial trap in reference to the hood outlet, the design seemed to be inadequate in other respects.

Samples were taken in ventilation ducts which contained the exhaust air from hoods in the normal foundry operations, and uranium concentrations



TYPE I TELESCOPING HOOD FOR INTERNAL OPERATIONS



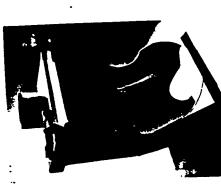
TYPE 2. PLEXIGLAS HINGED DOOR HOOD FOR EXTERNAL OPERATIONS



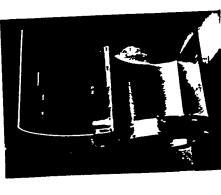
TYPE 3 PLEXIGLAS DOOR HOOD FOR LARGE LATHES



TYPE 4 LEVER OPERATED SWINGING HOOD FOR INTER-NAL AND EXTERNAL OPER-ATIONS



TYPE 5. SWINGING HOOD FOR EXTERNAL OPERATIONS



TYPE 6 PLEXIGLAS HINGED DOOR HOOD FOR EXTERNAL OPERATIONS

FIGURE I, HOODS FOR MACHINING NORMAL URANIUM

ranging from 0.0024 to 6.8 gr/ $1000 \, \mathrm{ft}^3$ were obtained. Preliminary data have indicated that a central air cleaning system for normal operations would be capable of handling the low loadings effectively.

Mercury Analysis in Urine

Information received at Kettering Laboratory was useful in setting up a method for the determination of mercury in urine. Some modifications were made in order to carry out the determinations on a routine basis. The digestion apparatus was altered so that the two digestions could be carried out in the same equipment instead of using a different apparatus for each digestion. The procedure itself was simplified so that it was possible for one person to do as many as sixteen determinations per day with a bank of eight digestion assemblies. The accuracy of duplicate determinations in this laboratory was within 0.02 milligrams of mercury per liter of urine. To date, approximately one hundred routine determinations have been made, and all but one show concentrations below 0.3 mg/liter.

Hexone Analysis

Since the last report on this work, the use of an explosimeter has shown that the concentrations of hexone in the air of Building 9211 do not create a fire hazard. The concentrations were not critical even during a simulated spill when hexone was splashed on the floor. An accurate method for the quantitative chemical determination of hexone in air in the range of 100 ppm has not been developed. Hexone determination in air may be possible by using an infrared spectrophotometer. Since this instrument is not available at the present time, some research and instrumentation work will have to be done prior to any hexone determinations.

PERSONNEL MONITORING

D. H. Reed and E. C. Long

Film Badges, Pocket Chambers, and Rings

During this period, film badges were furnished to 297 people regularly assigned to work in areas where a potential external radiation hazard was known to exist. A total of seventy-eight hundred visitor badges were worn and processed. Gamma-sensitive pocket chambers were supplied to 148 regular employees; and thermal-neutron-sensitive chambers, to 86 employees.

The rubber-covered film pads previously used to measure hand exposures have been replaced by plastic finger rings with screw caps. Identification of the rings is accomplished by placing the loaded rings in contact with lead numbers and producing images of the numbers in the emulsion by means of X-rays. Rings are used and processed on a weekly basis; while pocket chambers are read and recharged daily.

Urinalysis Processing and Results

Overcrowded conditions in the laboratory of Building 9706-2 resulted in a temporary move of the Urinalysis Group to an existing laboratory in Building 9202. In the future, a second move will be made into laboratories now being constructed in the same building. It is expected that coincident with this move new electroplating equipment will be placed in operation. Investigation is in progress to determine the type of power supply and plating cell to be used. Provision will be made for plating twenty samples simultaneously. Such an installation should materially increase the accuracy of the electroplating method by providing facilities for multiple analysis of each sample.

The fluorometric analysis of urine for uranium was resumed on May 1. A detailed description of the procedure is given in another section of the report.

A total of 7492 analyses, including 5416 electroplated (enriched uranium) and 2076 fluorophotometric (normal uranium), was performed during this report period. Figs. 2 and 3 indicate the distribution of the urine concentrations.

Fig. 2 for Area A, which is the enriched area of Building 9212, reflects certain events. At Point A, a rate sample replaced the 24-hour sample which had been taken weekly. For rate samples, the contributors are requested to submit a specimen as soon as possible after reporting to work on Monday. Present and preceding voiding times are recorded by the employee. This information, in addition to the volume of the specimen and the uranium concentration, is used to determine a value for the 24-hour excretion rate.

Point B indicates the date when twenty-one employees were removed from their work locations in Building 9212 because of elevated concentrations of uranium in urine. (See Internal Uranium Exposures). Point C denotes the transfer of foundry and machining operations which was initiated during the twenty-second week. The limiting value for the 90th percentile group exceeds the maximum permissible urinary concentration value of 70 d/m/24-hour voiding, and the 90th percentile group exceeds the MPL up to the time that the twenty-one people were removed from the 9212 operations. An additional ten per cent exceeds the MPL during the time before the twenty-one people were removed.

Because of the brief period during which fluorophotometric analyses were performed, no interpretation is attempted for the normal uranium operations in Building 9212 shown in the Area B Chart, Fig. 3. The 90th percentile, however, is below the maximum permissible urinary concentration of 50 μ gm/24-hour voiding.

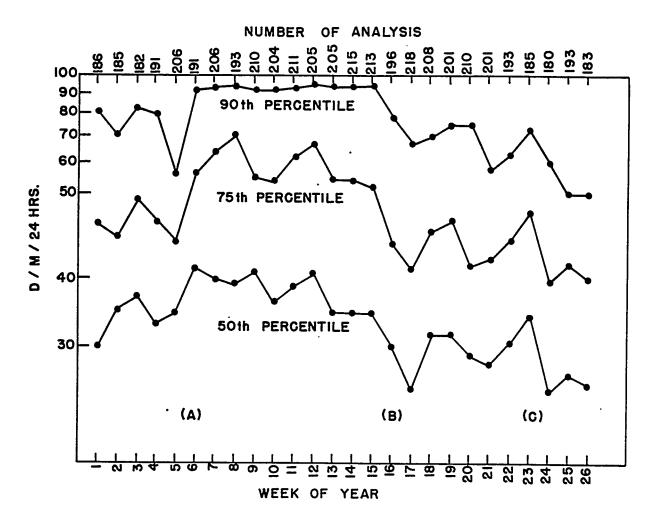


FIGURE 2. URINALYSES DISTRIBUTION. ENRICHED URANIUM —
AREA A — FOR JANUARY THRU JUNE 1952

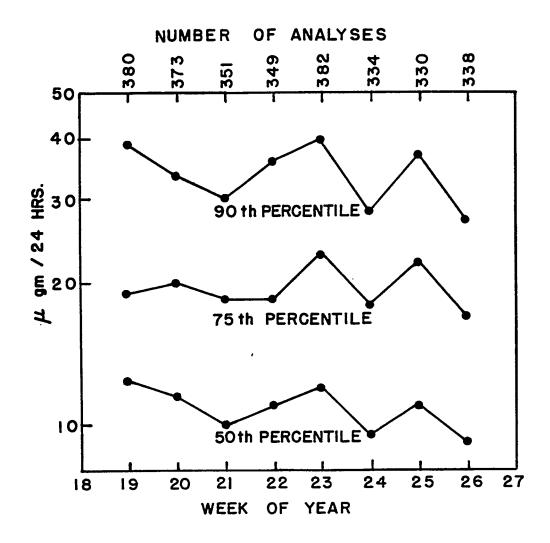


FIGURE 3. URINALYSES DISTRIBUTION-NORMAL URANIUM-AREA B-FOR MAY THRU JUNE 1952

AREA MONITORING

C. M. West and D. H. Reed

Air Sampling

During this report period, an extensive uranium air analysis program was continued in the plant areas where the highest levels of air contamination have existed. Since only a few air analyses were made in Area A (Building 9206), these results are not included in this report.

The quarterly results of the air analyses are presented in Tables 2 and 3. These tables give results as follows:

- 1. Whether the sampled contaminant was normal or product-level uranium.
- 2. Whether the sampled contaminant was water soluble.
- 3. Whether the type of sample was breathing zone (BZ) or general air (GA).
- 4. Whether the person performing the operation used protective respiratory equipment.

A study of the results in the accompanying tables shows a decline in the levels of air contamination between the first and second quarters of 1952. This decrease was brought about by: (1) the transfer of a large section of the operations to a new, larger, and better-equipped area, (2) the installation and more effective use of hoods and other localized ventilation, and (3) an effort on the part of operating departments to improve housekeeping and operating techniques.

To illustrate the improvement obtained by the aforementioned transfers, Table 4 compares the weighted means of the samples taken in the second quarter in the new area with those taken on the same operations in the old area.

Surface Surveys

A weekly surface contamination survey was initiated prior to the transfer of foundry and machining operations in Building 9212. This survey

TABLE 2

URANIUM AIR SAMPLES - FIRST QUARTER, 1952
(Area B)

Type of Material	Number of Samples	Average Sampling Time in Minutes	Weighted Mean in d/m/M ³	Туре	Respiratory Equipment
Normal - Insoluble	17	6	49,331	BZ	Yes
Normal - Insoluble	677	30	178	BZ	No
Normal - Insoluble	2370	316	75	GA	No
Enriched - Soluble	4	10	4,826	BZ	Yes
Enriched - Soluble	231	16	1,200	ΒZ	No
Enriched - Soluble	139	73	84	GA	No
Enriched - Insoluble	29	6	15,818	BZ	Yes
Enriched - Insoluble	225	10	3,231	BZ	No
Enriched - Insoluble	97	61	353	GA	No

was started three weeks before operations began in that area and has continued for thirteen weeks. Three weeks after operations started, a vigorous cleanup campaign was instigated by the Production Department. The averages of the smear results and other pertinent information are reported in Table 5.

Shipments and Intraplant Transfers

A total of 692 shipments was inspected for contamination and approved for shipment to points outside the Y-12 Plant.

An increase was noted in the number of inspections required for movement of material from contaminated buildings to other locations within the plant area.

TABLE 3

URANIUM AIR SAMPLES - SECOND QUARTER, 1952

(Area B)

Type of Material	Number of Samples	Average Sampling Time in Minutes	Weighted Mean in d/m/M ³	Туре	Respiratory Equipment
Normal - Insoluble	74	5	13,574	BZ	Yes
Normal - Insoluble	476	31	130	BZ	No
Normal - Insoluble	2249	318 :	45	GA	No
Enriched - Soluble	4	9 ·	2,545	BZ	Yes
Enriched - Soluble	66	12	125	BZ	No
Enriched - Soluble	180	551	6	GA	No
Enriched - Insoluble	95	8	8,718	BZ	Yes
Enriched - Insoluble	476	9	77	BZ	No
Enriched - Insoluble	410	471	18	GA	No

Building Surveys

A survey was made of eight of the buildings designated as noncontaminated areas. Included in this group are the cafeteria, dispensary, and several office buildings. Smears were taken at 1068 locations and counted in a gas flow proportional counter. Of this total, 1060 counted less than 20 d/m. Seven smears ranged from 20-43 d/m, and one result was 516 d/m. This location was rechecked after cleaning, and the count was below 20 d/m.

TABLE 4

AIR LEVELS ON COMPARABLE SAMPLES IN TWO AREAS

OLD AREA NEW AREA						
Operation Number	Number of Samples	Average Sampling Time in Minutes	Weighted Mean in d/m/M ³	Number of Samples	Average Sampling Time in Minutes	Weighted Mean in d/m/M ³
1	26	13	1,074	25	13	45
2	20	21	417	30	13	43
3	26	28	610	29	30	23
4	29	8	669	7	6	34
5	2	6	604	5	18	47
6	11	6	45,518	36	9	242
7	11	6	7,127	49	8	291
8	7	5	28,932	43	7	96
9	8	7	7,932	47	9	.77
10	9	12	2,017	14	15	129
General Room	52	40	296	175	765	17

TABLE 5

RESULTS OF 13 WEEKS OF SMEARS IN ENHANCED URANIUM AREA

1 33 Preparing for Operations None 4.4 2 33 Preparing for Operations Dilute HNO9 Solution Wash 43.8 4 43 Partial Operations Dilute HNO9 Solution Wash 126.8 5 44 Partial Operations Dilute HNO9 Solution Wash 607.6 7 40 Full Operations Dilute HNO9 Solution Wash 607.8 8 40 Full Operations Versine Wash-Water Rinse 325.1 9 40 Full Operations Versine Wash-Water Rinse 241.6 11 40 Full Operations Versine Wash-Water Rinse 241.6 12 40 Full Operations Versine Wash-Water Rinse 241.6 11 40 Full Operations Versine Wash-Water Rinse 241.6 12 40 Full Operations Versine Wash-Water Rinse 241.5 13 40 Full Operations Versine Wash-Water Rinse 241.5 13 40 Full Operations NaHCO3-H2O2 Wash, NH4OH Rinse 47.5	Week	Number of Smears	Operating Conditions	Cleaning Solution Used	Average of Smears d/m/100 cm ²
Preparing for Operations As Preparing for Operations Partial Operations Partial Operations Dilute HNO3 Solution Wash Full Operations Dilute HNO3 Solution Wash Wersine Wash-Water Rinse Prull Operations Wersine Wash-Water Rinse Pull Operations Wersine Wash-Water Rinse	1	. 33	Preparing for Operations	None	4.4
Partial Operations Dilute HNO3 Solution Wash Partial Operations Dilute HNO3 Solution Wash Partial Operations Dilute HNO3 Solution Wash Pull Operations Dilute HNO3 Solution Wash Pull Operations Versine Wash-Water Rinse	Ø	33	Preparing for Operations	None	11,5
43 Partial Operations Dilute HNO3 Solution Wash 2 44 Partial Operations Dilute HNO3 Solution Wash 2 40 Full Operations Dilute HNO3 Solution Wash 6 40 Full Operations Versine Wash-Water Rinse 3 40 Full Operations Versine Wash-Water Rinse 2 40 Full Operations NaHCO3-H2O2 Wash, NH4OH Rinse 2 40 Full Operations NaHCO3-H2O2 Wash, NH4OH Rinse 2	ဧ	43	Preparing for Operations	None	43,8
44 Partial Operations Dilute HNO3 Solution Wash 6 40 Full Operations Dilute HNO3 Solution Wash 6 40 Full Operations Versine Wash-Water Rinse 7 40 Full Operations Versine Wash-Water Rinse 8 40 Full Operations Versine Wash-Water Rinse 7 40 Full Operations Versine Wash-Water Rinse 8 40 Full Operations Versine Wash-Water Rinse 8 40 Full Operations NaHCO3-H2O2 Wash, NH4OH Rinse 8 40 Full Operations NaHCO3-H2O2 Wash, NH4OH Rinse 8 40 Full Operations NaHCO3-H2O2 Wash, NH4OH Rinse 8	4	43	Partial Operations	Dilute HNO3 Solution Wash	126,8
46 Full Operations Dilute HNO ₃ Solution Wash 40 Full Operations Versine Wash-Water Rinse 40 Full Operations NaHCO ₃ -H ₂ O ₂ Wash, NH ₄ OH Rinse 40 Full Operations NaHCO ₃ -H ₂ O ₂ Wash, NH ₄ OH Rinse	ស	44	Partial Operations	Dilute HNO3 Solution Wash	211,3
40 Full Operations Dilute HNO3 Solution Wash 40 Full Operations Versine Wash-Water Rinse 40 Full Operations NaHCO3-H2O2 Wash, NH4OH Rinse 40 Full Operations NaHCO3-H2O2 Wash, NH4OH Rinse	9	45	Full Operations	Dilute HNO ₃ Solution Wash	607.6
40 Full Operations Versine Wash-Water Rinse 40 Full Operations NaHCO3-H2O2 Wash, NH4OH Rinse 40 Full Operations NaHCO3-H2O2 Wash, NH4OH Rinse	7	40	Full Operations	Dilute HNO ₃ Solution Wash	607.3
40 Full Operations Versine Wash-Water Rinse 40 Full Operations Versine Wash-Water Rinse 40 Full Operations Versine Wash-Water Rinse 40 Full Operations NaHCO3-H2O2 Wash, NH4OH Rinse 40 Full Operations NaHCO3-H2O2 Wash, NH4OH Rinse	œ	40	Full Operations	Versine Wash-Water Rinse	325,1
40 Full Operations Versine Wash-Water Rinse 40 Full Operations Versine Wash-Water Rinse 40 Full Operations NaHCO3-H2O2 Wash, NH4OH Rinse 40 Full Operations NaHCO3-H2O2 Wash, NH4OH Rinse	o.	40	Full Operations	Versine Wash-Water Rinse	169,6
40 Full Operations Versine Wash-Water Rinse 40 Full Operations NaHCO3-H2O2 Wash, NH4OH Rinse 40 Full Operations NaHCO3-H2O2 Wash, NH4OH Rinse	10	40	Full Operations	Versine Wash-Water Rinse	241.6
40 Full Operations NaHCO3-H2O2 Wash, NH4OH Rinse 40 Full Operations NaHCO3-H2O2 Wash, NH4OH Rinse	. 11	40	Full Operations	Versine Wash-Water Rinse	278,2
40 Full Operations NaHCO3-H2O2 Wash, NH4OH Rinse	12	40	Full Operations	NaHCO3 -H2O2 Wash, NH4OH Rinse	47.5
	13	40	Full Operations	NaHCO3-H2O2 Wash, NH4OH Rinse	16.6

ACCELERATORS

L.C. Emerson and R.O. Wollan

86-inch Cyclotron

The activities during this report period centered, primarily, around the extended shutdown of the 86-inch cyclotron. The shutdown, which began on January 14 and ended March 1, was scheduled in order that certain modifications designed to improve cyclotron operations could be effected. Because of the increased volume of work, three additional Health Physics Inspectors were assigned to the area.

Operation of the cyclotron during the first six months of this year was limited; consequently, external exposures were reduced. Internal exposures, however, increased considerably. The problems associated with these exposures will be considered in the following sections.

Isotope Production Program - This program continued to present one of the greatest external-radiation problems in the plant area. Decreased production and improved target handling facilities have somewhat lessened the severity of personnel exposures.

Neutron Shielding - Additional improvements were made on the door frame and the I-beam directly above the maze entrance. The modifications have further decreased the neutron flux in adjacent areas. High fluxes were found at the refrigerant pipe entrance in the overhead shield. Additional shielding was sufficient to reduce this flux to a safe value.

Medical Examination - Quarterly physical examinations were made of cyclotron personnel, and no unusual findings were reported.

External Exposures - The film evaluations of approximately 1250 film badges issued to regularly assigned personnel are shown in Table 6. Each worker was also issued two pocket chambers sensitive to gamma radiation and two sensitive to thermal neutrons. Pocket dosimeters were issued to personnel working in the pit area or around high levels of radiation. No permanent record of the dosimeter readings has been kept, but their use is encouraged in an effort to keep exposures at a minimum.

<u>Air-borne</u> Contamination - Air samples for this report period are divided into two groups: (1) those obtained during the cyclotron shutdown, and (2) those obtained during normal operations. The former are reported

in Table 7, and the samples obtained during normal operations are reported in Table. 8 High air-borne contamination levels still exist in the alignment dock because of the contaminated equipment held over from the shutdown.

TABLE 6

EXPOSURE ANALYSIS IN THE 86-INCH CYCLOTRON AREA

Exposure Range (mrem/week)	Number of Exposures
<100	1144
100-300	88
300-500	11
500-1000	4
>1000	3

TABLE 7

AIR-BORNE CONTAMINATION DURING SHUTDOWN

Area	Number of Samples	Air-borne Contamination (d/m/M ³)
Pit, Before Tank Decontamination	18	1514
Pit, Before Room Decontamination	96	104
Pit, After Room Decontamination	44	81
Decontamination Facility, Inside	9	2077
Decontamination Facility, Outside Area	18	69
Alignment Dry Box	38	1155
Change House, Contaminated Side	31	193
Change House, Clean Side	40	49
General Building	167	16

Target Handling Facilities - The thickness of the radiation shield adjacent to the target exit port was increased to 42 inches. All operations involving the handling of irradiated materials can now be carried out from the control position behind a viewing port. Lead vaults are provided to store targets containing large amounts of undesirable short-lived contaminants. Those targets which may present a contamination problem are transferred through a sealed plastic box to a lead container. This container, after suitable target decay, is transferred to the target handling

area. Handling facilities consist of a series of dry boxes in which all necessary processing is carried out. All irradiated material is sealed in plastic containers before the material leaves this area.

TABLE 8

AIR-BORNE CONTAMINATION DURING NORMAL OPERATION

Area	Number of Samples	Air-borne Contamination (d/m/M ³)
Pit	31	212
Alignment Dry Box	12	1608
Contaminated Change House	5	22
General Building	. 17	. 5
Exhaust Air from Filters	5	15

The severity of personnel exposures during the handling of irradiated targets can varywidely. Probably the greatest factor contributing to these exposures is the time element involved. Short-lived material must be handled rapidly, limiting the use of awkward handling equipment. In addition, for short bombardments, the average number of irradiations per work shift is much higher than normal. Since estimations of the amount of activity to be expected from a particular bombardment have little value, monitoring measurements after each bombardment in the pit are necessary.

An additional bombardment facility was installed whereby neutron irradiations could be obtained without necessitating cyclotron shutdown. By means of a string, targets can now be lowered into bombardment position through a tube terminating at a point above the concrete shield. In general, the neutron-produced activities are low, resulting in relatively minor handling problems.

Decontamination Facilities - During the shutdown, the decontamination of large equipment was performed in facilities designed for that purpose. With one exception, this process operated smoothly and effectively. The removed contaminants were either trapped by an electrodeposition process or stored in closed tanks. Overfilling caused one spill, but the installation of float indicators on each tank will prevent the recurrence of the spill.

The use of an overhead crane to transfer the heavy equipment from the pit into the decontamination facility was necessary. This equipment had to be lowered into the enclosure through a 40-square foot hatch. An oversight in the design of the internal support structure required that all equipment be supported by the crane through the open hatch. Since the ventilation was designed for operation with a closed hatch, the face velocity at the opening was reduced to less than 50 feet per minute. As a result, high levels of air-borne contamination were present above the facility.

Plans have been started to extend the exhaust duct through the building roof into a suitable stack. This alteration will eliminate the hazard which now exists because of the possibility of filter rupture.

Alignment Dry Box - Alpha contamination in the alignment dry dock area was high; therefore, air line respirators were used in this area as well as plastic protective clothing.

Cyclotron Change House - The change house aided in preventing the spread of contamination from the pit area. The floors in both locker rooms were less contaminated than those in the contaminated locker room by a factor of 50 or more.

Air Ventilation - A filter unit was installed in the duct system carrying exhaust air from the cyclotron pit, the change house, and the target handling area dry boxes. During normal operation, the change house air is shunted through a bypass duct directly to the filter unit. A damper controlled by the position of the door to the pit closes the bypass when the door is open so that sufficient air velocity into the pit is maintained. Such a system is effective in restricting the high contamination levels to the pit.

<u>Plastic Covers</u> - The practice of enclosing contaminated equipment during transfers from one area to another was effective. All materials leaving the pit during the shutdown were either decontaminated or sealed in plastic covers. Both liner and dees were transported to the decontamination facility in a cover such as is shown in Fig. 4. These covers were sealed to the cyclotron tank before the liner and dees were removed so that contamination could not be exposed to the atmosphere.

Plastic suits and shoe scuffs were also fabricated and supplied to the personnel entering areas of high contamination. This equipment provided complete protection as long as the suit remained intact. Accidents were minimized by covering the plastic with laboratory coats and by making constant visual checks. Some of the protective equipment which was useful during the shutdown is shown in Fig. 5.

Other Accelerators - Monitoring continued, as previously reported, at the Van de Graaff generator, and the 63-inch and 22-inch cyclotrons.

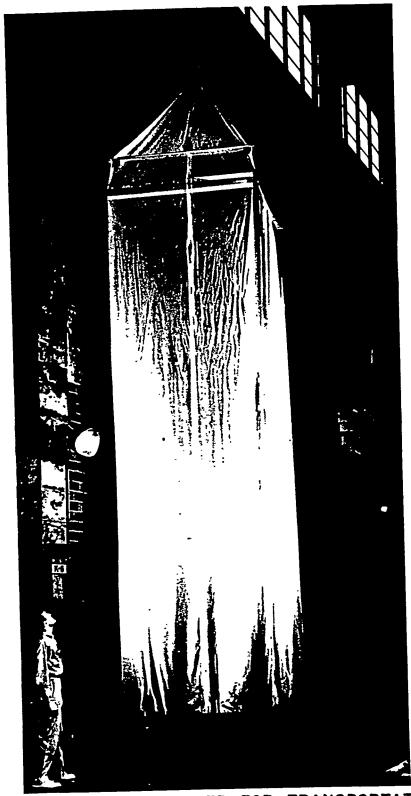


FIGURE 4. PLASTIC COVER FOR TRANSPORTATION OF LINER AND DEES



FIGURE 5. PROTECTIVE EQUIPMENT

ANALYTICAL RESEARCH

D. M. Ross

Fluorophotometric Analysis of Urine for Uranium

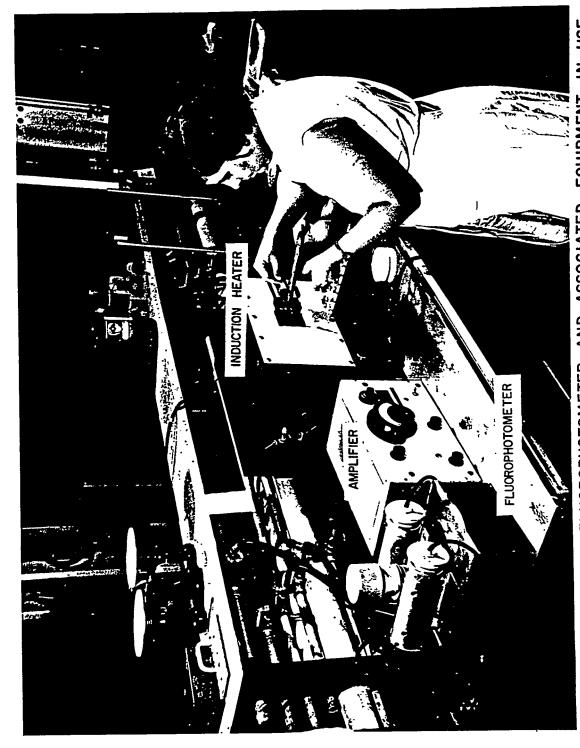
During this report period, urinalysis was reinstituted covering approximately 400 employees engaged in the production of normal uranium. The method chosen involved the use of the Model Q Fluorophotometer shown in Fig. 6. In actual practice, the following steps are employed in the analysis:

- 1. Pipette a 0.2-ml aliquot into a gold dish of 5/8-inch diameter. A larger aliquot is not feasible because of the quenching properties of urine, and a smaller one is undesirable from the standpoint of sensitivity. The detection of uranium of the order of 5 µgm/24-hour urine voiding is required. Thus, a smaller aliquot will make it impossible to measure this amount.
- 2. Evaporate the urine aliquot under a heat lamp. The remaining organic residue is burned off prior to the fusion in an induction heater.
- 3. Fuse with 300 mg of a mixed flux (20 per cent NaF · 80 per cent Na₂CO₃) in the work coil of an RCA 1 KW induction furnace. The coil will heat six dishes to the fusion point in less than two minutes.
- 4. Read the fluorescence intensity in the fluorophotometer. This instrument, with its two AH 4 ultraviolet sources and a new No. 5819 photomultiplier tube, detects the fluorescence associated with 1 x 10⁻⁹ grams of uranium.

Calibration of this method verified the linear relationship existing between fluorescence and uranium concentration. Statistical analysis of the calibration data indicates that the variance in the average of a triplicate sample is proportional to the amount of uranium present in the phosphor.

The 95 per cent limit of error (LE) was found to be \pm 0.37 \sqrt{X} x 10⁻⁹, where X is the coefficient of the exponential form for expressing the weight of uranium (in grams) existing in the aliquot of urine. A table illustrating this relationship follows:

х	95 Per cent LE (gms of uranium)
1	± 0.4 x 10 ⁻⁹
5	± 0.8 x 10 ⁻⁹
10	± 1.2 x 10 ⁻⁹
20	± 1.7 x 10 ⁻⁹



EQUIPMENT IN USE 6. MODEL Q FLUOROPHOTOMETER AND ASSOCIATED FIGURE

SPECIAL STUDIES

S. R. Bernard, J. C. Gallimore, and R. O. Wollan

Internal Uranium Exposures

To date, 10 to 30 per cent of the total number of urine samples analyzed for enriched uranium have exceeded the MPL of 70 d/m/24-hour voiding. Efforts to decrease this number have consisted of (1) installing more and better ventilating equipment, (2) reassigning employees excreting high levels of uranium to operations having low levels of air contamination, and (3) encouraging production personnel to improve house-keeping techniques.

On April 21, twenty-one employees, having an average exposure history of six years, were removed from the enriched area of Building 9212 until their uranium excretions were reduced to the average of their coworkers. The basis for this selection was the repeated occurrence of elevated urinary uranium concentrations. Since the change from a "Friday Evening" to a "Monday Morning" type sample revealed no appreciable change in the level, the uranium had probably been stored.

Immediately after leaving Area B, the twenty-one employees were given a complete physical examination by the Medical Department and were required to submit a 24-hour urine specimen daily for four weeks. The findings of the Medical Department were negative. The urinalysis results were, in general, reasonably consistent.

Initially, high uranium excretions accompanied by a marked day by day fluctuation were found. This was followed by a rapid decline during the first four or five days, after which a levelling off and continued slow decline in excretion rate was noted. Graphs of the results were plotted and posted in order that the employees could see them.

After four weeks of daily 24-hour sampling, the frequency was reduced to one 24-hour sample per week. The employees were informed that they would be allowed to return to their work locations when their urinary concentrations were below 30 d/m/24-hour voiding.

A "best fitting" curve, assuming exponential elimination, was used to determine when the urine concentration had reached the target value. The equation for the curve was determined by the method of least squares. The slope of the curve, along with its limit of error, was useful in determining the time at which the excretions reached the desired value. At

the time of this writing, all but five of the employees have returned to Area B. The average length of time that these employees were absent from the area was two months.

Neutron Monitoring

Since June 26, 1952, NTA emulsions (25 microns thick) have been included as a neutron detector in the film badges worn by the personnel operating the 86-inch cyclotron. These emulsions were carried for two weeks, exchanged, and microscopically inspected for proton recoil tracks.

By using a Po - Be source, control calibration exposures based on a tolerance value of 25 fast neutrons per square centimeter per second were made. Unexposed control emulsions were processed along with the calibration and personnel film.

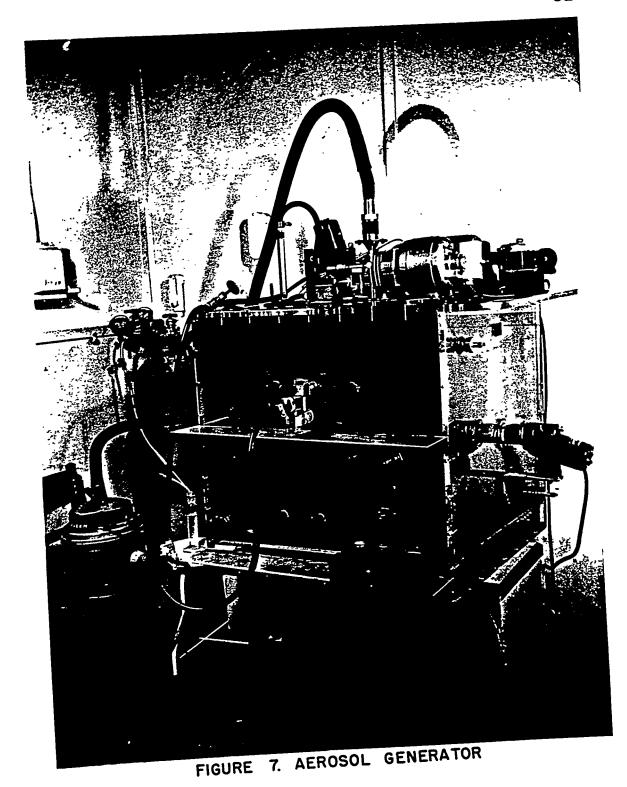
Since the energy distribution of the neutron flux at the cyclotron has not been determined, it was assumed for calibration purposes that Po - Be neutrons approximate the sensitivity of the emulsion to the accelerator neutrons. This assumption that the energy distribution of the degraded cyclotron neutrons approximates the Po - Be neutrons biases the exposures in the conservative direction since the tolerable flux increases as the neutron energy decreases below about 5 Mev.

A study is in progress to determine the energy distribution of these latter neutrons in order to make the necessary emulsion sensitivity corrections.

Aerosol Generator

Construction of the aerosol generator shown in Fig. 7 was recently completed. This equipment was designed for four possible uses: (1) cascade impactor calibration, (2) filter paper efficiency studies, (3) dust characteristic studies, and (4) training and instruction of personnel in the use of air sampling equipment for particle size distribution studies. Since time has not permitted an adequate study of the operating characteristics of the generator and chamber, its use has been limited to personnel training. The details of operation and design are as follows:

The particle generator is a simple ball mill, containing twenty-five 1/4-inch and twenty-five 3/16-inch steel balls (See Fig. 8). The mill is rotated by a 1/8-horsepower motor through a Graham transmission. The mill speeds thus obtained range from 0 to 35 rpm. The dust is transferred from the mill into the main chamber by the entry of nitrogen



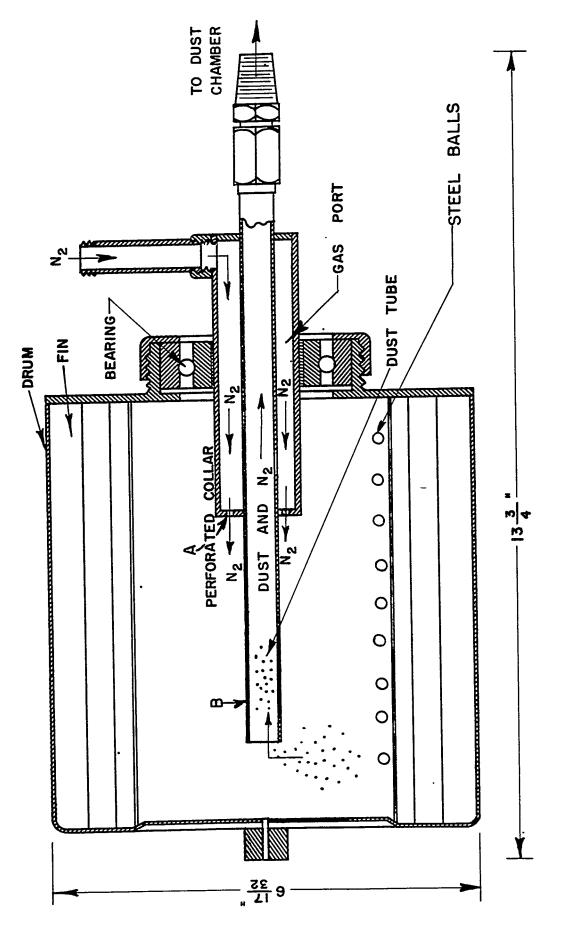


FIGURE 8. BALL MILL

through a perforated Collar A, shown in Fig. 8. The material is carried into Tube B, and thus into the chamber. The chamber, having a volume of about 1/2 cubic meter, is constructed of 3/4-inch Plexiglas.

Upon entry of the dust into the chamber through Inlet I, Fig. 9, a spreader fan, F_1 , is utilized. This fan is of variable speed (0-1500 rpm), and at present is being operated at approximately 200 rpm. To further the desire for uniformity of the dust distribution in the chamber, two additional fans, F_2 and F_3 , are situated on the sides of the chamber. To date, sufficient sampling has not been performed to determine the efficiency of these fans in the production and maintenance of a uniform dust distribution in the chamber.

From the chamber, the material is exhausted through valve, V_1 , with a commercial type vacuum cleaner operated at about $60\,\mathrm{fl}^3/\mathrm{min}$. The exhaust of the vacuum cleaner is directed into the top of the chamber through valve, V_2 .

This arrangement is undesirable because of the known inefficiency of the filtering material in the cleaner for small particles (<1 micron). If allowed to pass by the filter, the particles are then fed into the chamber, shifting the size distribution and making the maintenance of a constant chamber concentration impossible. In addition, because of the closed system, negative pressure in the chamber is unobtainable. In the future, a filter paper of high efficiency will be used in the cleaner, and the cleaner will be exhausted to the atmosphere. A filter will be placed in the inlet valve, V_2 , in order to eliminate the entry of nuisance dust into the chamber. Thus recirculation will be eliminated, and the desired negative pressure will be maintained in the system.

The chamber, as seen in Fig. 9 is equipped with nine air sampling heads. Five are located in the face and two on each side. Also, six modified cascade impactor parts are available. Three are in the upper half and three in the lower half of the front.

Particle Size Studies

As reported previously under the subject, <u>Internal Uranium Exposures</u>, twenty-one employees in the enriched area of Building 9212 were transferred to less contaminated areas because of urinary concentrations consistently exceeding the MPL. Since the exposures were primarily the result of inhalation of air-borne uranium, a study was begun to determine the particle size distribution of this material to see if the size of the air-borne uranium was favorable for upper or lower respiratory retention.

Therefore, a laboratory was chosen which contributed individuals yielding the highest urinary concentrations.

Thirty-two cascade impactor samples were taken in this laboratory (Room 44D, Building 9212), and the mean of the 32 geometric mass medians was 2.75 microns. The limit of error of this mean $(2\sigma/\sqrt{n})$ was \pm 0.03 microns.

The contaminant in this laboratory was assumed to be uranium tetrafluoride, and the impactor stage calibration constants were calculated accordingly. The possibility existed that other compounds of uranium, such as uranium oxide (U_3O_8) and uranium dioxide (UO_2) , might also be present. The oxide, having a density of 7.3 gm/cm³, as compared with 7.1 gm/cm³ for the tetrafluoride, would not shift the mass median size appreciably if it were being sampled together with the tetrafluoride. However, if sufficient dioxide were present (density - 10.9 gm/cm³), the median size determined by the impactor, using the tetrafluoride stage calibration constants, would be high, because more of the heavier compounds would be removed by the first stages.

With only these two possible contributing contaminants, the size as given by the impactor (2.75 microns) can only be about two per cent high if the oxide accompanied the tetrafluoride or about twenty per cent high if the dioxide were included with the tetrafluoride. Thus, the particle size of the air-borne uranium in that laboratory, according to Brown, Cook, Ney, and Hatch, ¹ was within the range of sizes favorable for lower respiratory retention.

Similar studies are planned for other laboratories contributing to the overexposed group in order to compare the particle size distributions at the different locations.

^{1.} Brown, Cook, Ney, and Hatch, American Journal of Public Health, Vol. 40, p 450 (1950).





This document contains 42 pages.
This is copy 26 of 131, Series A.

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CARBIDE AND CARBON CHEMICALS COMPANY A Division of Union Carbide and Carbon Corporation Y-12 PLANT

W-7405-eng-26

HEALTH PHYSICS PROGRESS REPORT

November 1, 1950 - December 31, 1950

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I. INTRODUCTION

With the issuance of this report the practice of submitting quarterly statements of progress pertaining to Health Physics in the Y-12 area is established. Since the program is largely in its formation stage, such formation having extended over the past eighteen months, the first reports are expected to be quite comprehensive and detailed purporting to document all matters of importance and interest to management and others.

A large part of the activities of this department is associated with work of a highly classified nature and must necessarily be treated within the bounds of security restrictions; consequently, any real or apparent restraint in reporting can be attributed to an effort to avoid security violations.

In connection with the work in the uranium industry, designed to protect the health and well-being of persons employed therein, there is planned, and in the process of being implemented, a long range program to study the chronic effects of long term inhalation exposure to minimal and sub-minimal concentrations of uranium and its various compounds. These data will be published via interim reports on a limited distribution as frequently as significant trends develop. Meanwhile, this study will proceed under the guidance of representatives of the Atomic Energy Commission, and the University of Rochester School of Dentistry and Medicine.

It is of interest to report that the department has grown from a nucleus of four in 1948 to its present roll which numbers a total of twenty-one. Of that number, five are classed as Health Physicists, four are Chemists, two are Medical Technicians, one is an Industrial Hygiene Engineer, and the remainder include clerical and technical personnel. It is to be expected that this number will increase, at least by a factor of two, as the activities which require this service get under way.

In a similar manner, for reasons that are obvious, department facilities have been, and are being expanded. There are two analytical laboratories, two counting laboratories, one instrument calibration station and several offices. These facilities are separately displaced within the Medical Building and in separate buildings as well which leaves a great deal to be desired in problems pertaining to supervision. The present plans include the assembly of all department activities into one of the unused buildings in the area with enough floor space to accommodate the present needs and allow for an anticipated expansion.

CONFIDENTIAL

II. EXTERNAL RADIATION HAZARDS

(L. C. Emerson)

External radiation hazards are considered to be those hazards resulting from particulate or electro-magnetic radiations emanating from sources external to the body. Three general sources of radiation recognized at this site are: radio-active materials, accelerators, and experiments with critical masses. The existence of health problems relative to accelerator operation and criticality experimentation in the Y-12 area are of fairly recent origin. In effect this has lessened the problems of the health physicist; his suggestions can be incorporated into operating procedures as they are conceived rather than necessitating changes in old and well established procedures.

Maximum Permissible Exposure Limits

The maximum permissible exposure limits in use at this installation are those that were officially adopted by the Radiation Protection Committees of the United States, Great Britain, and Canada at a meeting in Chalk River on September 29 and 30, 1949. These limits are indicated in Table I. For monitoring purposes, whole body exposure is assumed when radiation is received to any portion of the body other than the hands or forearms. Because of the uncertainties in the value of the Relative Biological Effectiveness for fast and slow neutrons, the maximum permissible fluxes were obtained by averaging the values calculated by several recognized workers in the field. The maximum permissible flux of 65 fast neutrons/cm²/sec per 40 hr week was obtained from calculations by Gamertsfelder, 1 Mitchell, 2 and Morgan, 3 while the maximum permissible flux of 1600 slow neutrons/cm²/sec per 40 hour week was obtained from calculations by Mitchell, 4 Snyder, 5 Tait, 6 and Morgan. 7

Gamertsfelder, C. C., "Calculations for Use with the Fast Neutron Meter." AECD-2173, July 21, 1948.

^{2.} Mitchell, J. S., 'Provisional Calculation of the Tolerance Flux of Fast Neutrons.' British Journal of Radiology, 20, 177, (May, 1947).

^{3.} Morgan, J. Z., Unpublished Data.

^{4.} Mitchell, J. S., "Provisional Calculation of the Tolerance Flux of Thermal Neutrons." British Journal of Radiology, 20,79, (February, 1947).

^{5.} Snyder, W. S., "The Calculations for Maximum Permissible Exposure to Thermal Neutrons." Nucleonics, 6, 2, 46, (February, 1950).

^{6.} Tait, J. H., 'The Calculation of the Energy Deposition in Soft Tissue by Thermal Neutrons.' AERE-TR-416, October, 1949.

^{7.} Morgan, K. Z., Unpublished Data.

TABLE I

Maximum Permissible Dose Limits in "Reps" per Week

Type of Radiation	At any Point Within the Body	Relative Biological Effectiveness	In the Basal Layer Exposure of Entire Body	of Epidermis Exposure of Hands Only
X-Rays and Gamma Rays	0.3	1	0.5	1.5
Beta Rays	. 3	1 .	. 5	1.5
Protons	. 03	10	. 05	0.15
Alpha Rays	. 015	20	. 025	0.075
Fast Neutrons	203	10	. 05	0.15
Slow Neutrons	. 06	5	. 1	0.3

Sources

Neutron Sources. Most of the neutron sources (Ra-Be and Po-Be) at this installation are used in experimental facilities which are carefully controlled and adequately shielded. Consequently, once the handling procedures have been established, the health physics services evolve into routine periodic checks. Instrument calibration with Po-Be sources is also a standardized operation in that the majority of the calibrations are made at one location, and usually, by the same operator. Any unusual operation or transfer involving neutron sources is done under the supervision of health physics personnel.

The neutron sources are stored in accordance with accepted practices. They are surrounded by some hydrogeneous material, such as paraffin or water, degrading the fast neutron component by proton scattering. The resulting slow neutrons are then captured by the various elements in the scattering medium. For some of the larger sources it is customary to enhance the probability of capture by the addition of borax.

Gamma Sources. Radioactive sources in this area are used for radiographic work, process monitor checks and instrument calibration. These sources are used only by persons familiar with the hazards involved.

Several small (1.1 mgm) Ra gamma sources are used for routine checks of Process Monitors and radiation instruments. This type of source is mounted in a brass capsule on the end of a 5 foot probe so that it is unnecessary for the user to expose himself to a dangerous gamma flux.

Three gamma sources, viz., 4.55 mgm Ra, 23.0 mgm Ra and 250 mc Co, are situated in a lead pig behind a concrete barrier in the Instrument Calibration Station. These sources, under remote control, are used in the calibration of personnel meters and low range radiation instruments. A nine Curie Co source, used in the calibration of high range survey meters, is also located in this area. Control of this source, within an 18 foot well, is effected by means of an electrically operated link-chain mechanism incorporating safety interlocks to prevent over-travel of the suspended support platform. Details of this arrangement at the top of the well are shown in Figure 1.

The largest gamma source at this site (15 Curie Co) is used in the Radiographic Laboratory. Elaborate safety devices have been incorporated in the design of this laboratory to insure adequate protection to operating personnel.

Source Location. The following sources are in use at this installation:

Location	Number	Type
Assay Laboratory (9203)	4	Ra-Be
•	1	Po-Be
Health Physics (9983)	2	Ra
11001111 1 111 1111 1111	2	Co
	1	Ta
	1	Po-Be
Instrument Department (9737)	2	Po-Be
mstrument Departure (1997)	2	Ra
Electro-magnetic Laboratory	2	Po-Be
(9201-2, 9204-3)	2	Ra
Product Chemical Department (9212)	1 .	Ra
Radiographic Laboratory (9212)	1	\mathtt{Ra}
itadiographic Educations (1.1.)	1	Co .
Chemical Department (9206)	1	Ra
Plant Shift Supervisors (9706-2)	1	Ra

FIG. I. WELL FOR CALIBRATION OF HIGH RANGE INSTRUMENTS

Accelerators

22" Cyclotron. A small cyclotron has been installed in one of the "beta tracks" for use as an aid in studying ion sources, beam deflection, and associated problems. A proton beam of 2 MEV has been obtained, but, since this is below the threshold of most nuclear reactions, the radiation problem has been negligible.

86" Cyclotron. The high current cyclotron has been completed and tests have been made with proton beams up to 26 MEV. Beam currents as high as 5 ma have been obtained. A majority of the tests have involved the (p,n) reaction on copper. The high beam currents obtainable result in the copious production of fast neutrons. The cyclotron is mounted on a level below the ground floor at the east end of one of the alpha production buildings (9201-2). The dees are positioned in the vertical plane, making it possible to introduce the target assembly from below. Shielding for the cyclotron consists of five-foot concrete walls supporting a five-foot concrete ceiling. Two mazes in this shield are the only openings into the pit.

At present, a study is being made to determine the effectiveness of the shield in reducing the fast neutron and gamma radiations. This study has been hampered up to the present time because it has been impossible to maintain a steady beam. However, preliminary measurements, with a fast neutron flux of $10^6 n/cm^2/sec$ inside the pit, indicate that the fast neutron and gamma fluxes outside the shield are below the accepted MPL.

A serious health physics problem associated with the cyclotron has been the handling of targets subsequent to bombardment. It is not uncommon for the zinc activity resulting from copper bombardment to reach a level of 20 r/hr with a 50 ua beam of a few seconds duration. Fortunately, the target activity is usually short-lived, so, if the target is allowed to "cool," the activity decays to a safe level. Removal of a "hot" target is done only under the supervision of a health physicist. It is customary for the workers to wear lead gloves while working on the target assembly. Hand monitoring is accomplished by finger pads or plastic finger rings, the details of which are discussed in the Routine Surveys section of this report. Plans have been made to construct a remotely controlled system for the removal of "hot" targets.

X-Ray Machines. Ten x-ray machines in use in this area range in size from 40 KEV, 16 ma machine to a 1 MEV, 10 ma machine. The tubes are mounted in a more or less fixed position in locations complete with the necessary shielding.

Experimental Criticality Laboratory

The experimental set-up has been partially completed and limited operations have been started. The health physics services rendered at this laboratory are sufficient to require the full time of one health physicist. Low level operations are monitored at the working area while those operations approaching criticality are observed and controlled from behind five feet of water. Radiation levels behind the water shield are so low as to be undetectable with present instruments. Alpha hand counters are provided for personnel working on the assemblies. Permanent air samplers are being installed in the reactor areas and at the assembly tables. These samplers will be in continuous operation during any specialized operation.

III. INTERNAL RADIATION HAZARDS

(S.R. Bernard and D.M. Ross)

Uranium

In general, the internal radiation hazards extant in this area arise from the handling and processing of soluble and/or insoluble forms of normal or enriched uranium or their various compounds. Exposures to personnel are due in most part to uranium particulates present in the atmosphere. The exposure hazards are evaluated by general-atmosphere and/or specific-operation air sampling. The chief evidence of exposure is the excreted amount of uranium in urine.

To achieve the duality of purpose in the long range program, referred to in the introductory section of this report, the following procedures have been or are being established: (1) routine 24 hr urine samples collected once per week and analyzed for uranium; (2) routine and extensive air sampling carried out in order to determine an index of inhalation exposure (particle size measurements to be included); (3) routine hand counts taken with a view to controlling rather than monitoring exposure by ingestion; and (4) routine quarterly Industrial Health Rechecks. This examination includes the usual clinical procedures in addition to other blood and urine tests specifically related to uranium toxicology.

In addition to the existing air-borne uranium problem, it is anticipated that the plutonium project, now in an advanced planning stage, will be of serious concern to the Health Physics Department.

<u>Maximum Permissible Limits</u>. The maximum permissible limits of normal and/or enriched air-borne uranium presently in use is 70 d/m/M^3 based on 8 hr/day, 5 days/wk, 50 wk/yr. This is in agreement with the MPL of 50 ugm/M^3 (3.4 $\times 10^{-11} \text{ uc/cc}$) for normal uranium recommended by W. F. Neuman of the University of Rochester. The permissible urinary limits have been taken to be 70 d/m/24 hr in all cases, which value corresponds to 50 ugm/24 hr of normal uranium.

Neuman, W. F., "Urinary Uranium as a Measure of Exposure Hazard," Health and Biology Section, University of Rochester, UR-82, July 1, 1949.

Air Sampling. Uranium processing may be subdivided into a number of batch operations. Air sampling presents a means of evaluating the hazards at the various work locations. The multiplicity of operations characteristic of this batch process, and the limitations of man power have resulted in the sampling, principally, of those operations where air-borne uranium in excess of the MPL of 70 d/m/M^3 was considered most likely to occur.

Air samples are classified as breathing zone (B. Z.) and general air (G. A.). The former are samples taken at specific operations where the concentration of air-borne particulates is of most concern to the operator. General air samples, as the term implies, are samples taken with the view to obtaining a representative sample of the general air in a room or work area.

Table II represents a composite of the results of 402 air samples obtained in the uranium processing areas "A" and "B" during the fourth quarter of 1950. The operations have been separated into normal and enriched with further subdivision into the soluble and insoluble compounds. The specific activity and solubility of the uranium compounds differ markedly and are therefore reported separately.

TABLE II
Air-borne Uranium

		No. of	Av time	Wt. mean	Type of	Resp.
Type of	Material	Samples	of sample	$d/m/M^3$	Sample	Equip.
		25	20	21,372	B.Z.	Yes
		34	27	37	B.Z.	No
Normal	Insoluble	49	124	382	G.A.	Yes
		8*	114	10	G. A.	No
		21	27	598	B. Z.	No
,		18*	125	11	G. A.	Yes
		10	6 .	1,659	B.Z.	Yes
	Soluble	20	29	490	B.Z.	No
		8	93	45	G. A.	No
Enriched		9	8	2,076	B.Z.	Yes
	Insoluble	130	16	1,366	B.Z.	No ·
		70	76	80	G. A.	No

^{*} These results differ only in that they originated in different areas.

It is noted from the table, that in certain operations where air-borne uranium exceeds the MPL by factors as high as 10⁴, the wearing of protective respiratory equipment is required and hence, the hazards involved

are substantially reduced. Other high-level concentrations involve operations which are of short duration and consequently do not present the hazard which might be inferred from a cursory examination of the tabulated data. The time of sampling varied from approximately 5 to 300 minutes, therefore, the weighted mean was calculated for each type of sample rather than the mean or median because the weighted mean tends to compensate for this wide variation in sampling time. Similar tabular results in future reports may be used for purposes of comparison.

<u>Urinalysis Program</u>. Urine is the normal body excretion best suited for analysis for uranium. The mode of analysis is dictated by the isotopic concentration of U-235 in the exposure atmosphere. The urine taken from employees working with normal uranium is analyzed fluorometrically while that from personnel exposed to enriched uranium is analyzed by an electroplating and counting technique.

Personnel actively engaged in uranium processes and exposed to dusty atmospheres are cooperating quite satisfactorily to the extent that one 24 hr urine specimen is submitted periodically for uranium determination. A 24 hr urine specimen submitted weekly is the goal of the program, but, due to limitations in laboratory facilities and analysis equipment, and other factors inherrent in a production program, it has not yet been attained. However, some groups are submitting weekly samples and it is hoped that others, who are now participating on a monthly basis, will soon follow.

Urine specimens are analyzed for (1) uranium, (2) albumin, (3) amino-acid nitrogen, (4) creatinine, and (5) catalase. Analyses (2) through (5) are designed to detect kidney damage which may result when uranium is present in the body. Although none of these is specific, each contributes evidence which tends toward specificity in determining kidney changes.

It is recognized that one of the major obstacles to meaningful determinations is the likelihood of contamination of urine collected during working hours. To minimize this problem separate facilities have been made available. Wherever possible, these facilities consist of rooms in the work area where outer clothing may be removed, hands washed and counted, and specimens stored under refrigeration. Specimen carriers, containing five 210 ml bottles with caps, are provided by the Health Physics Department for samples voided during the off-work hours.

Urinary uranium determinations are made on 50 cc aliquots of the evaporated specimen. The fluorescent property of uranium lends itself to the quantitative determination of the element in urine. The limit of sensitivity of the fluorometric method of analysis has been determined to be four parts per billion. Normal uranium is extracted with penta-ether, compounded with a

suitable flux, the fluorometric properties of the phosphors determined, and the uranium content of the 24 hr sample calculated. The analysis of urine containing enriched uranium differs in that an electroplating technique is used. The enriched uranium concentrate is prepared and electroplated on a silver disk which is subsequently counted in an alpha proportional counter. Analysis results are reported to supervision in terms of $ugm/24 \, hr$ (normal uranium) and in $d/m/24 \, hr$ in the case of enriched uranium.

During the period covered by this report 1152 urinalyses were performed. Of this number, 78 showed excreted uranium exceeding the arbitrary reporting level of 50 d/m/24 hr. The highest excretion level of enriched uranium was 795 d/m/24 hr; that of normal uranium 78.2 ugm/24 hr. Figure 2 shows the urinalysis results for workers in the enriched uranium processes while Figure 3 shows the results for those working in the normal uranium operations. It may be noted from these cumulative percentage polygons that there was no significant change in excretion levels during the period.

In general, the excreted amount of normal uranium was well below the MPL of 50 ugm/24 hr. However, a substantial number of employees in the enriched areas excreted uranium in excess of the MPL of 70 d/m/24 hr. The cumulative polygons of Figures 2 and 3 are based on urinalysis results of specimens submitted on a monthly basis. For purposes of identification this area is referred to as area "B." In area "A," weekly specimens are submitted. The results are shown in Figure 4 where the medians, 75th percentiles, and 90th percentiles have been plotted in terms of ugms/24 hr versus the week of the year in which the samples were collected. Again it may be noted that there was no trend indicating a change in the excreted levels.

Plutonium

The calutron has been used in the past for the collection of U-235, the collection of a wide variety of stable isotopes, and the purification of U-234. Now, for the first time, it is to be used to separate the isotopes of Plutonium and thereby facilitate more accurate measurements of their nuclear properties. The first objective is the purification of Pu-240 followed by Pu-242 and possibly Pu-244.

Extremely high alpha activity is the serious problem involved in adapting the Beta Calutron to plutonium separation. During operation the plutonium will be widely dispersed throughout the calutron units, and, being in the dry state, may present an acute inhalation problem if not properly contained. Considerable chemical and unit handling facilities will be required. Plans for

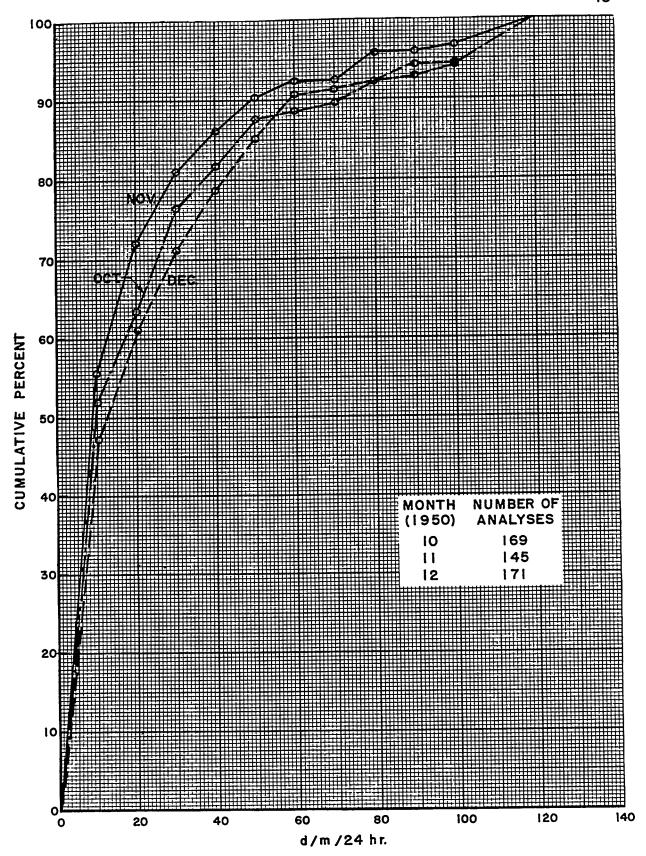


FIGURE 2 URINALYSIS, ENRICHED URANIUM - AREA B

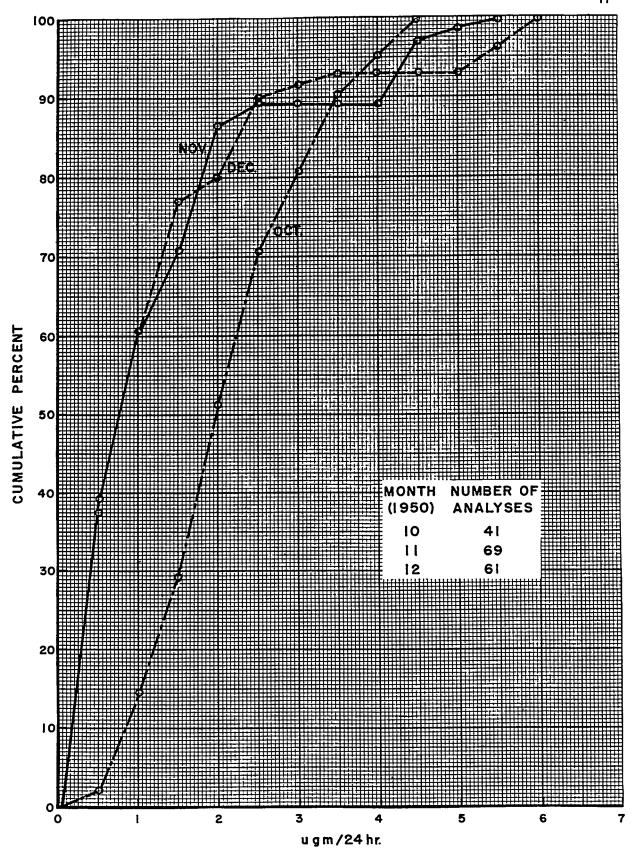


FIGURE 3 URINALYSIS, NORMAL URANIUM - AREA B

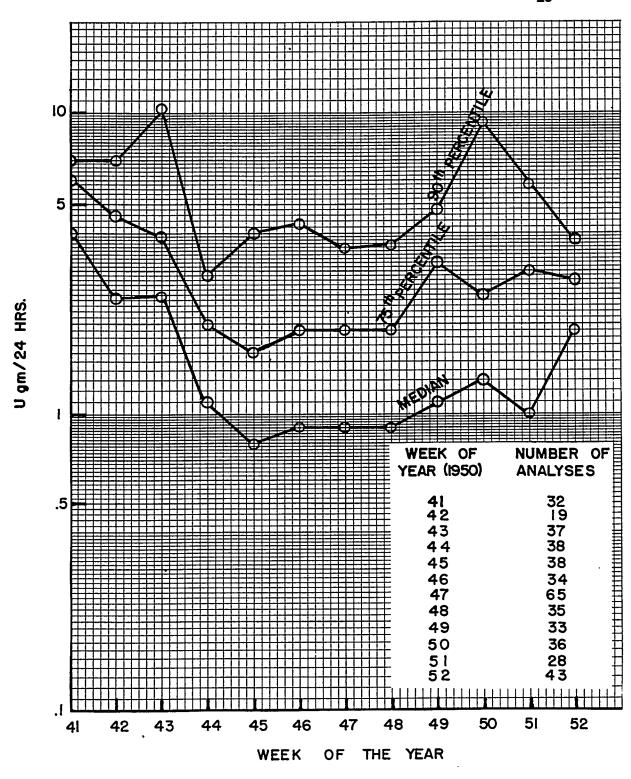


FIGURE 4 WEEKLY URINALYSIS, AREA A FOR OCT., NOV., AND DEC. 1950

the safe operation of the chemical processes are largely complete since they may be carried out within evacuated gloved-boxes. Because of their complexity resulting from unit bulkiness and the magnitude of the radioactivity involved, the problems associated with the transportation and washing of the calutron units have not been completely resolved.

The Health Physics Department will follow this program very closely and will assume the responsibility for detection of any hazardous conditions which may develop. A series of permanently installed air samplers included in the lay-out of the chemical laboratory will facilitate the detection of lapses in safe operating procedures while portable air samplers operated by Health Physics personnel will be used to investigate each individual step of the calutron process.

IV. ROUTINE SURVEYS

(E.C. Long and O.M. Wisdahl)

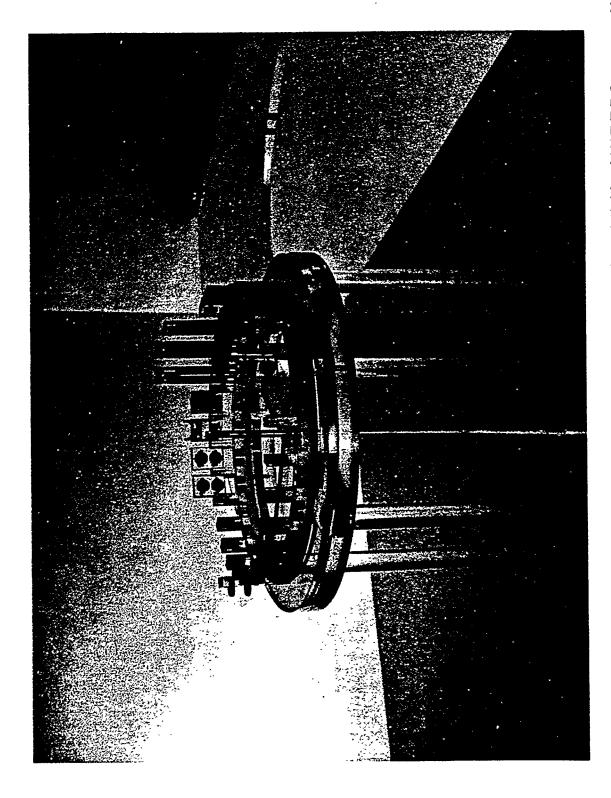
Personnel Monitoring

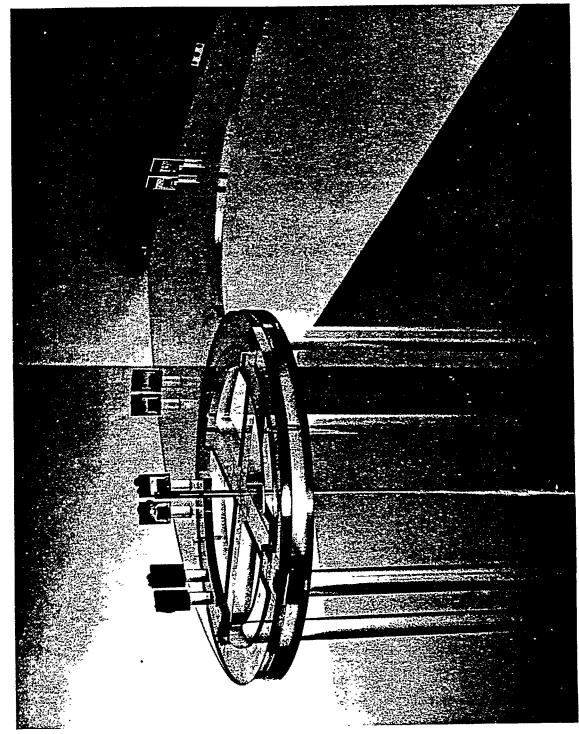
Personnel working with, or in the vicinity of, radiation sources are equipped with two general types of personnel radiation meters; viz., photographic meters, which yield permanent records, and pocket chambers which give ephemeral readings. The latter indicate the need for processing photographic meters at other than regularly scheduled intervals.

During the three months covered by this report 2371 pocket chambers were processed, of which 1491 were gamma-sensitive and 880 were neutronsensitive. A total of 8196 film meters, including 6875 rings and 1321 badges, were also processed.

Film Calibration. Film meters are calibrated against beta, gamma and x-rays. For beta calibration the film meter is placed in contact with a slab of natural uranium, the exposure being calculated on the basis of 240 mrep/hr at the surface of the uranium. Cognizance is taken of 5 mr/hr gamma flux also present at this surface. Gamma calibrations are performed with a radium source assuming a radiation of 8.4 roentgens per hour per milligram of radium at a distance of I centimeter; the radium being enclosed in 0.5 mm of platinum. Provision is made for either of two methods to be used in calibrating film to gamma radiation. First, all films may be placed at the same distance from the source by means of a specially constructed ring enabling exposure of many pieces of film to the same radiation flux. Different dosages may be obtained by removing the film at the end of a desired time interval. The ring will accommodate pocket chambers, film badges, plastic rings, and rubber finger ring meters. The plastic ring is shown in Figure 5 with badges, rings, pads, and pocket chambers in position. Secondly, a sequence of various radiation exposures to film, pocket chambers, plastic rings, or pads exposed for the same period of time may be obtained by using a rack which is provided with stations so arranged that each station receives one half the radiation flux at the station immediately preceding. An electric timer may be used to raise and lower the source for pre-set time intervals. Figure 6 shows this rack with badges located at several of the stations.

Pocket Chamber Calibration. Pocket chambers are tested and calibrated monthly. The chambers are charged and shaken for fifteen minutes and then read. If the charge loss is less than 15 per cent, the chambers are given a leak test by charging and leaving them for twenty-four hours. At the end of





this time the chambers which have not lost more than 10% of the original charge are given an exposure to gamma radiations from a radium source. Upon reading, chambers correct to within 10% are considered good and put back into service. Chambers which fail any of these tests are taken out of service and repaired or retired.

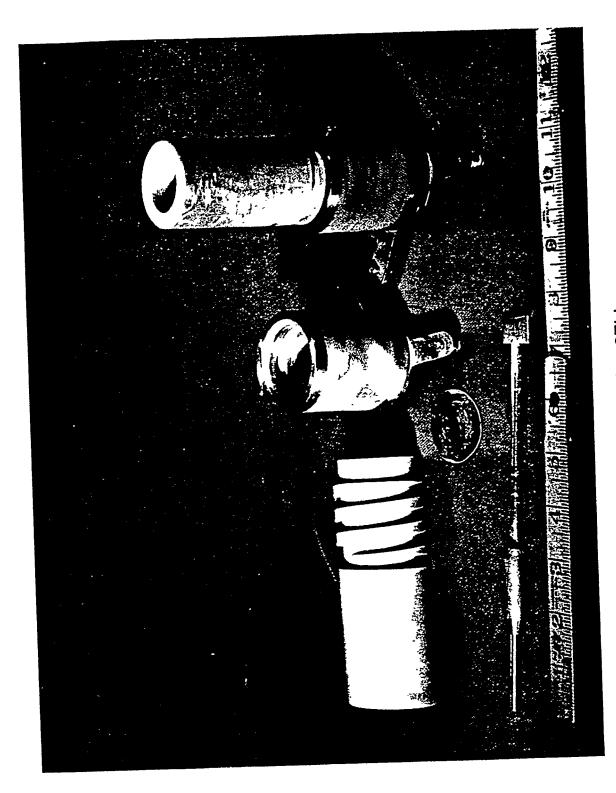
<u>Urinalysis</u>. Urine specimens must be collected in locations apart from the work area in order to minimize potential contamination. A new Health Physics laboratory has been established in Building 9212 to facilitate the collection of urine with one medical technician and a lab analyst in attendance. A total of 1152 urinalyses were made during the period covered by this report.

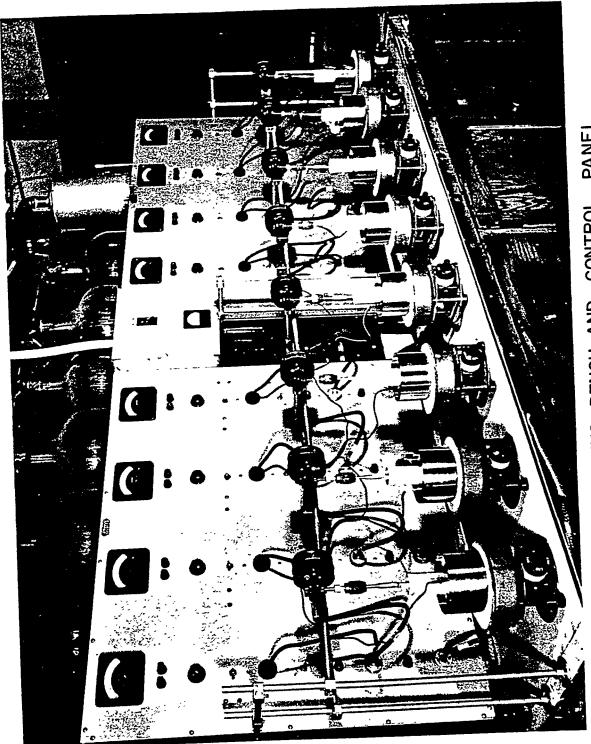
Two changes have been effected in the electroplating apparatus used in uranium urinalysis. The cells have been modified to incorporate features which will make them rugged and easy to disassemble and clean. The cells consist of two parts: a stainless steel inside-threaded cup and a cylinder made of Teflon with threads cut into the outer surface, the pitch being such that two and one-half revolutions will assemble these components. Figure 7 shows two cells, one assembled and the other disassembled. Variable speed stirrer motors have been replaced with constant speed motors and remounted, one rack being used for all the motors replacing the individual racks previously used. Figure 8 shows the bank of plating cells and the controls panel.

Area Monitoring

Area monitoring, consisting of routine radiation surveys, daily water sampling and analysis, air sampling, routine shipments inspection, building surveys, inspection of intra-plant transfers of materials and/or equipment, and surveys of an individual or special nature, was continued during the period. The cassette program, initiated previous to the period covered by this report, was expanded to include that portion of the building housing the Cyclotron which is of concern from a radiation hazard viewpoint and the experimental criticality building. In order to provide instruments and equipment for monitoring use by Health Physics personnel in the event of a major plant disaster, "Catastrophe Kits" were permanently located at four widely separated points of entry to the plant area.

Cassette Program. A total of 92 Cassettes, installed in selected locations in five buildings, are presently in use. In two of these buildings, the Cassettes are used as a means of obtaining the integrated dosages at points of interest; in the remaining sites, they are used in conjunction with Area Process Monitors. These monitors are located in certain areas where penetrating radiations, of an emergency nature, are deemed likely to occur.





ELECTRO-PLATING BENCH AND CONTROL PANEL

In general, film used for radiation dosimetry measurements darkens slightly as it ages. This is particularly true if the film is exposed to rather high temperatures or to temperature fluctuations. Hence, all Cassette films are changed on a routine monthly basis to avoid errors which may be introduced in density determinations from these causes. Emergency film changes are made as emergencies arise. When a Process Monitor activates an alarm, signifying an emergency, all Cassette films within a 50 ft. radius of the monitor are processed as soon as practicable. If no reasonably accurate estimate of the radiation intensity at or near the site of the monitor can be determined from the density of these films as read on the Densichron, ¹ the processing of Cassette films at distances greater than 50 ft from the monitor is indicated. For purposes of calculating the dosage at the monitor, when dosage at a given point is known, the inverse square law is assumed to hold. The attenuating effect of intervening walls in these calculations is disregarded since it is assumed to be negligible.

Sewer Analysis. Continuous water sampling is done at the outlet end of the Y-12 storm sewer. A motor driven, turbine type pump, installed on the bank of the water channel, is used for this purpose. A second, duplicate unit, is kept at the site in reserve. Composites are made of the continuous water samples taken during each 24 hr period, and at the end of the week a four liter aliquot is withdrawn for (1) uranium analysis by the fluorometric method, (2) uranium analysis by counting techniques, and (3) pH determination. A qualitative determination of the uranium concentration in the liquid disposal from the area is achieved by the first two analyses noted above. A compilation of the data collected during the period covered by this report is presented in Table III.

TABLE III
Storm Sewer Analysis

Month	No. of Weekly Samples	pН	Uranium in ugms/100ml	Uranium in c/min./ml
October	4	6.91	nier 1.2	0.32
November	· 4	6.60	1.7	0. 32
December	4	7. 30	1.1	0. 25
Quarterly Av	erage	6.90	1.3//	0.30

^{1.} For details of construction and operation of this instrument refer to Carbide & Carbon Chemical Division Report No. Y-616, "An Evaluation of the Universal Magnephot Densichron as a Film Monitoring Densitometer" by E. C. Long.

Air Sampling

Portable Air Samplers. The 1.3 cfm, Model 2NF-10, Gast Air Pump illustrated in Figure 9, is mounted on a folding, tri-pod stand equipped with casters. The sampling head, shown in Figure 10, is clamped to a four foot boom cradled in an adjustable bracket inclined at an angle of 45° to the horizontal. This arrangement permits adjustment of the sampling head to various levels above the floor. An additional length of hose, over that required for sampling with the boom in the fully extended position, is provided so that the operator may, by holding the sampling head in the hand, take air samples at operations or in places which are relatively inaccessible. A total of 16 portable air samplers are now in use.

Permanent Air Samplers. Permanent air samplers are used in a number of areas where the nature of the operations is such that air monitoring, on a continuous basis during working hours, is deemed desirable. The details of this type of air sampling equipment is discussed in the Industrial Hygiene section of this report.

Filter Paper. Whatman No. 42 filter paper is used for the collection of uranium and allied radioactive, air-borne particulates. A paper collection efficiency of 80% is assumed in all calculations. A limited number of collection efficiency tests made during this period indicated a somewhat higher value. It is felt that further studies are needed, however, to justify the use of a higher figure. The paper is cut to size from stock by a special paper punch. The diameter of the paper disc used is 1.25 inches; when in position in the sampling head, it has a collection cross-section of approximately 0.78 sq in.

Air Flow Rate. An air flow control valve and rotameter are connected in the air line between the sampling head and the pump. The flow rate, on a sampler to sampler basis, varies over a rather wide range. In general, the sampling rate of all indoor air samplers is in the range between 0.30 cfm and 0.60 cfm. Routine, monthly calibrations are performed on all portable air samplers. A wet test meter is used for this purpose.

Counting. Keleket Scalers equipped with NMC Proportional Counter Converters, model PCC-10, are used for counting air samples. The background of these instruments was found to be quite consistently less than one count per minute. The minimum counting time per sample was arbitrarily set at five minutes except in those cases where high activity forbade it due to scaler limitations. A maximum of thirty minutes or a total of 1600 counts, whichever occurred first, was taken as the upper time limit. The selection of these limits was chosen with the view to reducing the total man hours required per week for

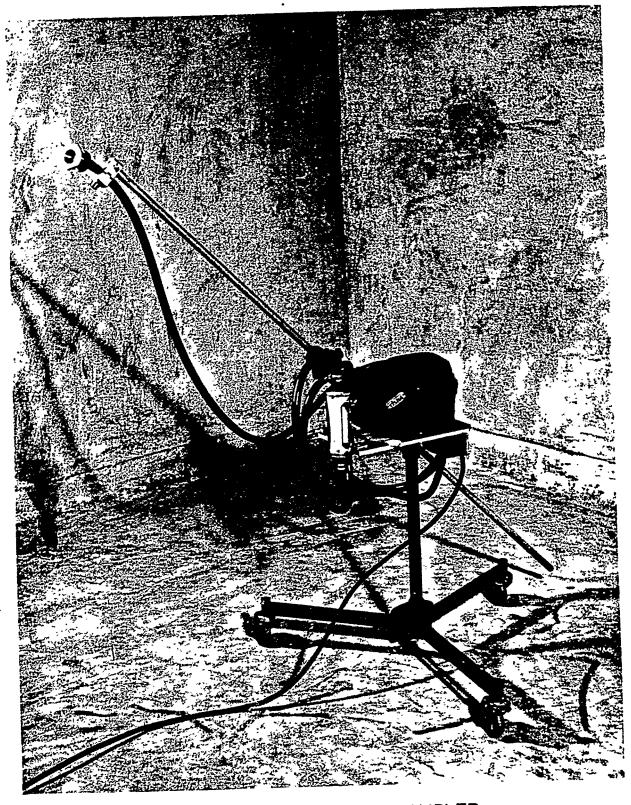


FIG.9. PORTABLE AIR SAMPLER

FIGURE 10. AIR SAMPLING HEAD

counting purposes. These time limits are felt to be consistent with the degree of accuracy desired and in keeping with the over-all accuracy of the air sampling techniques presently in use.

Equipment and Materials Inspection

Shipments. Outgoing shipments of materials and/or equipment from (1) the Shipping and Receiving Department, (2) Electrical Stores, (3) Chemical Stores, and (4) Salvage Department were inspected for radioactivity and/or contamination on a routine basis. Other shipments were inspected upon request. Appropriate tags are attached to the shipments as prescribed in Y-12 Plant Standard Practice Procedure No. 20-B. A total of approximately 250 shipments were inspected during the period.

Transfers. Radiation inspection of interdepartmental transfers of materials and/or equipment originating in "hot" buildings or areas was done in accordance with the provisions of Standard Practice Procedure No. 37. "Hot" buildings or areas are defined as those buildings or areas wherein radioactive materials are processed or handled, or which have a past history of such use, or which are known to be contaminated. Approximately 500 articles were inspected during the period covered by this report.

Surplus Clothing. Surplus issue-clothing destined for final disposition by the Laundry Department was inspected for contamination on a routine weekly basis. Approximately 2000 pieces were checked during the quarter.

Other Radiation Surveys. Extensive radiation surveys were required in Building 9201-2 during the early start-up and operating periods of the Cyclotron. The effectiveness of the shielding will be determined when the cyclotron is in operation for periods of time of such duration as to make the necessary surveys possible.

Monitoring, General. Materials and/or equipment with (a) alpha contamination greater than 500 d/min, as determined by direct measurement at the surface with a suitable alpha survey meter, or (b) beta-gamma contamination exceeding 0.04 mr/hr in contact with the probe are not released to commercial channels. All equipment and/or materials destined for salvage are monitored by direct measurement techniques; future disposition by salvage is governed by the contamination limits noted above.

Surface contamination standards for intra-departmental transfers of materials and/or equipment are based on smear tests made on readily accessible surfaces. The limits selected and the method of tagging are as follows: (These tags are shown in Figure 11.)

- 1. Alpha Contamination.
 - a. 0-500 d/min. ---- "Materials Transfer Tag" only required.
 This item is safe to handle.
 - b. 500-10,000 d/min. ---- "Contamination Tag" is used which indicates that precautions in handling are required. The precautions to be taken are prescribed on the tag by the Health Physics Inspector.
 - c. Greater than 10,000 d/min. ---- "Hazard Tag" is required, indicating that the item is grossly contaminated and special techniques are required for safe handling.
- 2. Beta-gamma Contamination (direct measurement).
 - a. 0-2 b.g. --- "Materials Transfer Tag" only is used; indicates no hazard exists.
 - b. 2 b.g. 12.5 mr/hr. ---- "Contamination Tag" is used indicating that the upper limit at the surface is of the order of tolerance value.
 - c. Greater than 12.5 mr/hr. ---- The "Hazard Tag" is used. The handling of items of this order of contamination require special instructions by the Health Physics Department. In most instances, transfers of materials and/or items of equipment emitting corpuscular and/or gamma rays exceeding 12.5 mreps/hr at the surface, are supervised by Health Physics representatives.



BACK

CAUTION SEE OTHER SIDE BACK FROM C124 MATERIAL TRANSFER APPROVAL 0

FRONT <u>ક</u>

FIG. II. TAGS FOR SPP-37

V. INSTRUMENTATION

(S. R. Bernard, L. C. Emerson, E. C. Long, D. M. Ross, O. M. Wisdahl

For the most part, instruments in use at this site are standard models of those that have been developed and used at other installations. Generally, these instruments have been satisfactory. However, with the advent of the criticality laboratory, the new accelerators, and increased research with radioactive material, the need for better and more diversified instruments has become evident. It is anticipated that the coming months will necessitate an expansion in the development and procurement of instruments better suited for the health physics services rendered here.

Instrument Development

Proton Recoil Chambers. Four paraffin lined proton recoil chambers have been constructed by the Instrument Department. These chambers are cylindrical in shape with the paraffin coated on two disks mounted perpendicular to the axis of the cylinder. They are filled with two atmospheres of purified methane. The chambers are operated in the proportional region and as such are relatively insensitive to gamma radiation.

One of these chambers is to be used with the Nuclear Instruments and Chemical Corporation (Model 2111) survey meter as a portable fast neutron instrument. Preliminary tests indicate that the sensitivity of this instrument is low, but for high neutron fluxes it should be satisfactory.

A combination survey meter and monitor has been constructed and is now undergoing preliminary tests with one of the new chambers. I This instrument has a full scale sensitivity of 50 neutrons/cm²/sec. The monitor is designed for continuous operation and incorporates an alarm circuit that is set off whenever a tolerance flux of fast neutrons is reached.

Continuous Air Monitor. A model of the continuous air monitor developed by F. F. Davis of the Oak Ridge National Laboratory has been obtained and is being used to sample for air-borne alpha emitters. The contaminated dust is drawn on to a moving filter paper by a Tornado pump operating at 4 cfm. Alpha pulses are counted by a thin window ion chamber, amplified,

^{1.} Farber, R. J., "Fast Neutron Continuous Monitor and Survey Meter," ORNL-590, March 16, 1950.

fed into a scale of 32, and recorded on an Esterline-Angus operational recorder. The instrument has just been installed and, as yet, only incomplete results have been obtained.

Another continuous air monitor, similar to the one developed by J.D.H. Kuper at Brookhaven National Laboratory, is now under construction. This instrument uses a scintillation counter for the detection of alpha contaminants and a thin window GM tube for the detection of betagamma contaminants.

Fluorophotometer. An improved model of the Oak Ridge National Laboratory fluorophotometer is under construction for use in the urinalysis program. This instrument should have a linear response and give reproducible results in the range from 10⁻⁷gm to 10⁻¹⁰gm of uranium. Simplicity, reproducibility, sensitivity, and rapidity in reading weré prime factors considered in the design of this instrument.

Alpha Hand Counters. Six four fold alpha hand counters are under construction by the Instrument Department. These instruments simultaneously count both sides of each hand for alpha contamination and indicate tolerance levels by means of a red light. The counting period is automatically timed, the entire operation being actuated by a micro-switch in one of the hand ports.

Hot-Cold Bulb Flowmeter. A flowmeter designed by the Instrument Development Section of the Oak Ridge National Laboratory has been obtained and is now under test. This instrument uses two Edison-Spindorff heater units connected in a standard bridge circuit. The deviation from the null point can be taken as a direct indication of the rate of air flow as the resistance of either arm is a function of the heat removed by the moving air stream. Plans are under way to construct several models of this instrument.

Calibration and Repair

The Instrument Department is responsible for the calibration of all health physics instruments. Calibration cycles are run for a period of one month, with special calibrations of any instrument made upon request.

All instruments are calibrated in the Health Physics Instrument Calibration Station. This station contains sources and equipment sufficient for the calibration of all beta and gamma measuring instruments for ranges up to 50 r/hr. Figure 1 shows the Co - 60 well for the calibration of high

range instruments. The switch at the right rear corner of the desk controls the movement of the source; its position being indicated on the two dials seen above the switch. The movable lead shield is used to cover the well when the source is not in use. Behind the cement barrier, shown in the background, are the sources used for calibrating low range instruments and personnel film.

At the time of calibration all instruments are routed through the repair section for routine mechanical and electrical checks. Any instrument needing extensive repairs is replaced by a spare where necessary. The calibration and repair of health physics instruments requires the full time services of two men and half time of a third.

VI. INDUSTRIAL HYGIENE

(W. H. Baumann)

The detection, evaluation, and control of non-radiological environmental health hazards is a function of the Industrial Hygiene section. The activities in which the section is presently engaged are: air analysis program covering all operations and processes in which beryllium and its compounds are handled; appraisal of non-radiological health hazards through the medium of air sampling; coordination of the air sampling program with preventive engineering measures designed by the engineering department; testing of ventilation systems with air flow measuring instruments; and consultation with safety and engineering departments as well as other interested groups on equipment selection and design wherein health hazards may arise.

Beryllium.

Beryllium Handling Facilities. A machine shop has been established in Building 9766 for the machining of beryllium metal and its compounds. The essential safeguards and precautionary measures were incorporated in this shop during the initial planning stage in an effort to afford the machinists maximum protection from the beryllium hazard. During the fourth quarter of 1950, personnel in the shop were engaged, almost exclusively, in the machining and handling of beryllium metal and some beryllium oxide. Many diversified machining operations were carried on in this shop. Most of the machining was done dry; however, some lathe operations, including drilling and boring, involved the use of a special liquid coolant.

A pre-wash laundry is located in Building 9206. Protective clothing, issued to personnel in the Machine Shop, is changed daily. With special care, the soiled clothing is transferred to this laundry, washed and centrifuged, and then forwarded to the main laundry.

All beryllium samples are analyzed in the Spectrographic Laboratory. Similar samples from another plant are processed in this laboratory.

A small group of research chemists are engaged in work using small amounts of beryllium fluoride in Bldg. 9733-2. The beryllium fluoride is mixed with other materials and heated in small electric furnaces. The fused mixture, after cooling, is handled within a recirculating type dry box.

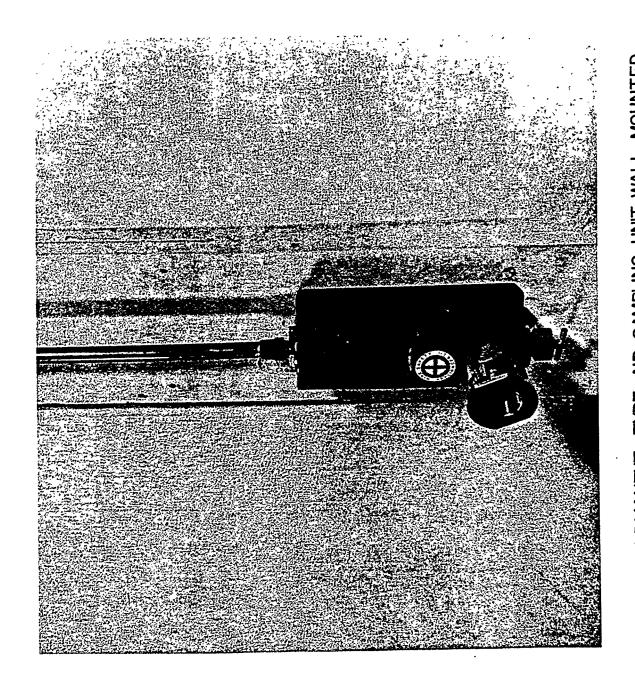
Small amounts of other beryllium compounds are handled in Buildings 9733-1 and 9733-2. Powdered materials are used within dry boxes; some compounds are handled in solution. This analytical work is done by several analysts and then only infrequently.

A laboratory is being constructed in Bldg. 9201-2 for the exclusive analysis of beryllium compounds. In the initial planning and design of this laboratory, health protection features (ventilation, sanitation, locker and washfacilities, air scrubbers, continuous air samplers, etc.) have been integrated with the laboratory facilities. When the new laboratory is ready for operation a routine air sampling and housekeeping program will be instituted.

Air Analysis. Whenever beryllium and its compounds are handled, air samples are taken for the purpose of measuring the extent of beryllium air contamination and/or the severity of the exposures. In areas designated specifically for beryllium handling (9766 Shop), continuous air samplers are mounted permanently at breathing levels and are located at strategic spots throughout the work area. A continuous sampler unit, shown in Figure 12 consists of a filter paper holder to accommodate 1 1/8" Whatman #44 filter paper, a control value for air flow adjustment, and a small rotameter. Several samplers are arranged in parallel and connected to a vacuum pump. Samplers are calibrated individually to operate at an air flow rate of 0.011 cubic meters per minute. These samplers are operated continually throughout the shift and the filter papers are changed daily. Spot samples are taken at various operations to measure the exposure of the employee or to determine the amount of contamination arising from a given operation. Filter papers, following collection of the air-borne beryllium, are placed in crucibles arranged in a plastic carrying container and submitted to the Spectrographic Laboratory for analysis. Blank filter papers containing known amounts of beryllium are submitted as a check on the spectrographic analysis.

Beryllium air findings for the fourth quarter of 1950 in the Beryllium Machine Shop are compiled in Table IV. A total of 1324 air samples were obtained. Of the 741 general room atmosphere samples taken with the continuous samplers, none exceeded the MPL of 2 ugm/ M^3 . Three hundred-seventeen operational and breathing zone samples gave an average amount of 1.1 ugm/ M^3 . Of these 317 Be-Air concentrations, 36, or 11 per cent, exceeded 2 ugm/ M^3 ; 32 of the 36 were between 2 and 10 ugm/ M^3 and 1 was greater than 25 ugm/ M^3 . Approximately 5 per cent of these samples were of short duration (\leq 15 min.).

Air samples were taken daily on the influent and effluent sides of the CWS #6 filters that serve as finishing filters. These findings should not be interpreted as a measure of the filter efficiency. The effluent stationary sampler does indicate the order of magnitude of the concentration of beryllium going into the discharge stack.



PERMANENT TYPE AIR SAMPLING UNIT, WALL MOUNTED

TABLE IV

Beryllium Air Analyses, 4th Quarter, 1950

Area	Type of Sample	Location	Number of Samples	Beryllium-	Beryllium-Air Concentration ugm/M ³ Minimum Maximum Average	ion ugm/M³ Average
	General Room	Locker Room	73	0.001	0.9	0.08
Machine Shop	Atmosphere	Machine Shop Area	520	0.002	0.55	0.07
Building 9766		Tool Grinding Area	74	0,001	0.12	0.03
		Storage Room Area	74	0.002	0.57	0.04
	Operational and Breathing Zone		317	9000 0	29. 2	1.1
	Filter House	Influent	72	90.0	30.3	1.38
·		Effluent	71	< 0. 0001	9.0	0.016
	Outdoor	500' ENE of Stack	62	<0.0001	0, 005	0.0005
		500' WSW of Stack	19	<0.0001	0.002	0, 0003
Laundry Building 9206	General Room Atmosphere		8	. 0.01	. 60 0	0.05
Room 1 Building 9733-2	Operational and Breathing Zone	Analytical Laboratory	12	<0.0001	0.2	0.05
Spectrographic Taboratory, 9212	Breathing Zone		2	0.03	0. 05	0.04

Permanent air sampler stations were placed 10 stack heights (500 feet) ENE and WSW from the stack discharge. The sampler locations were selected after a study of local meteorological conditions by the AEC Meteorological Section of Oak Ridge. The AEC has proposed an off-plant air pollution limit for beryllium in air of 0.01 ugm/M³. None of 123 pollution samples exceeded this standard.

In other areas where beryllium and its compounds are handled intermittently, spot samples were taken. These results are also compiled in Table IV for the three areas which were investigated during the fourth quarter. Of the twenty-two air samples taken in these areas, none exceeded 2 ugm/M^3 .

Control. Positive engineering control was incorporated into the design of the machine shop. The general room air supply is heated during the winter season. The total volume of room (on the basis of 10 machinists) is about 7,500 cu ft/man which indicates more than ample space allotment.

A local exhaust ventilating system is provided at each machine by means of a 5 in. diameter flexible rubber hose. The volume of air per outlet is approximately 550 cfm. Individual plastic hoods, designed to meet the control requirements for given machine operations, are exhausted through the flexible hose. If air concentrations were found to be excessive after a hood was installed, the hood was altered and the effectiveness rechecked by means of air sampling.

Stringent housekeeping is observed; personnel protective clothing changes are required daily. Ample lavatory and locker facilities are provided so that the employees are not required to leave the shop during the work shift.

In other areas, where beryllium is handled, controls are set up after careful investigation of the operation. Whenever possible, small beryllium operations are confined to ventilated chemical fume hoods or dry boxes.

The past occupational history is considered and a pre-placement physical examination is made by the Medical Director before employees are assigned to work with beryllium. Detailed records are maintained on employees exposed to beryllium and its compounds. Vital Capacity tests and weight checks are made biweekly on all employees working in the Beryllium Machine Shop. In addition, chest x-rays and physical examinations are taken every three months. Other personnel, working part-time with beryllium, are similarly checked at three month intervals.

Mercury

Mercury is used in most laboratories; consequently, vapor contamination of the air is potentially existent. Routine monthly investigation of laboratories for mercury contamination in air has been started. Due to the magnitude of the beryllium air analysis program during this period, mercury vapor pollution in air has been investigated on a request basis only. Plans are under way to monitor certain areas where mercury is used in fairly large quantities on a regular schedule.

Air Analysis. The G. E. Mercury Vapor Detector is utilized for the detection of mercury vapor in air. This instrument is commonly employed in industrial hygiene field studies for evaluating mercury vapor contamination of workroom atmospheres.

A study was made in Room 14 (Bldg. 9733-3) for mercury contamination. Only 1 finding out of 15 exceeded the hygienic standard for mercury exposures of 0.1 ugm/M³. Samples were taken at breathing level.

One of the warehouses (Bldg. 9720-5) was checked for mercury surface contamination. Breathing level concentrations approached 0.1 mg/M^3 in N. E. section of the warehouse. Mercury contamination of the floor was excessive throughout this general area.

Control. The most effective control measure for suppressing mercury contamination in air is good housekeeping. Positive findings, i. e. findings in excess of the exposure standard, are attributed to poor housekeeping. A vacuum cleaner, employing a hopcalite filter which absorbs mercury vapor, is being built for use in cleaning up areas contaminated with mercury. An attempt has been made to interest a private manufacturer to design and build a hand portable vacuum cleaner for use in cleaning up mercury metal. Several engineers from the Oak Ridge Plants met with an industrial representative and outlined the desirable and essential features which should be incorporated in the cleaner.

A commercial product, HgX, has been used in small quantities in one of the laboratories handling considerable mercury. This compound reacts with the exposed surface of the mercury globules to form a mercury compound which is non-vaporizing. This material is being used as a cleaning aid to reduce vapor contamination.

Turpentine

Turpentine is used in a coolant mixture for certain lathe operations in beryllium machining.



Air Analysis. A method of collection and analysis for evaluating turpentine vapor contamination in air was developed. Sintered-glass bubblers, arranged in series, containing absolute alcohol were connected through a rotameter to a Wilson Air Pump. The air flow through the equipment was calibrated and the sampling rate adjusted to 0.5 1/min. A colorimetric method of analysis was used in determining the amount of turpentine collected during the measured interval of time.

Six samples were collected during normal operation and all results were well below the hygienic standard for turpentine in air of 100 parts per million. Notwithstanding the low findings, several of the machinists complained of the disagreeable odor of turpentine.

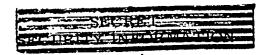
Control. Canopy hoods were installed above the lathes for control of vapor prior to air sampling. The hoods were found to be inadequate for the removal of turpentine odors, however, the condition was eliminated when varsol and kerosene were substituted for turpentine.

Liquid Metals

Research is being done on liquid metals, i.e., sodium and lithium, in certain areas. The metals are handled at elevated temperatures and pressures in closed systems. In the event of leaks in the system, extremely irritating, caustic fumes are evolved. The exposures, for the most part, are of short duration, and, being unpredictable or accidental, are not subject to evaluation. Consequently, no air samples have been taken in these areas. Certain on-the-spot emergency treatment measures have been provided at the sites where the liquid metals are handled.

The groups actively engaged in research activities involving the liquid metals have selected representatives who meet weekly with members of the safety and fire protection groups to set up protective measures in handling and disposal procedures.





Index No. Y-836
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Safety

CARBIDE AND CARBON CHEMICALS COMPANY A Division of Union Carbide and Carbon Corporation Y-12 PLANT

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HEALTH PHYSICS PROGRESS REPORT

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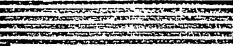
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SECRET SECURITY INFORMATION



I. INTRODUCTION

This report covers the activities of the Health Physics Department during the first half of the calendar year 1951 rather than the first quarter only. This departure from the established policy of quarterly reporting is being made in an attempt to make up for the delay in the assembly and distribution of the previous report¹, and in an attempt to avoid such delays in the issuance of subsequent progress reports. It is hoped that in the future it will be possible to issue progress reports within the first month following the report period.

Plans for the conversion of part of Building 9711-1 to facilities suitable for health physics activities are proceeding slowly. As soon as the preliminary engineering is finished, an estimate of the cost will be submitted to Management along with a request for approval of construction. When and if the building is converted, adequate and centrally located facilities will be available for the work of the department, and the present difficulties arising from working in more or less make-shift quarters will be eliminated.

An 'On-The-Job' training program for health physics personnel was inaugurated within this report period. At present particular emphasis is being placed on the practical aspects of the health physics procedures in use at this site in order to effect some degree of standardization. Another immediate objective of the training program is to provide information needed to clearly define each employee's duties and responsibilities. Later on, the course of instruction will deal with the fundamentals of instrumentation and dosimetry in general, in order to raise the level of related knowledge in these fields within the department.

The department also is engaged in conducting a portion of the Plant Orientation Training Program for new employees. The department's contribution to this program consists of a one-hour lecture each day on the general subject of health protection measures in force within the Y-12 area.

The training given under the sponsorship of ORINS and ORNL to certain A.E.C. fellowship students, was extended this year to include one

SECRET SECURITY INFORMATION

^{1.} Struxness, E. G., Health Physics Progress Report, November 1, 1950 - December 31, 1950, Report No. Y-780, C&CCC (Y-12 Plant), June 14,1951.

week of practical work at this Plant. A group of 20 A.E.C. Fellows in Radiological Physics, in teams of 2-4 men each, will receive throughout the summer months a week of practical training in health physics under the supervision of members of this department.

Representatives of the department attended the April meeting of the American Industrial Hygiene Association at Atlantic City, and the Air Cleaning Symposium at the Harvard Graduate School of Public Health in May. W. H. Baumann, Industrial Hygiene Engineer, presented a paper at each meeting on the subject 'Handling Procedures Associated with the Machining of Beryllium."

II. INTERNAL RADIATION HAZARDS

(S. R. Bernard, D. M. Ross, E. G. Struxness)

Uranium

As a result of expanded uranium operations during the report period, the Health Physics Department has had to hire additional inspectors, increase the number of permanent air samplers, and collect and process more urine samples than before.

Air Sampling. Of the 497 samples taken during the first quarter of the year 50 per cent were general air (GA) type samples. During the second quarter 90 per cent of the total of 1249 samples taken were GA samples. During the second quarter the sampling time also increased, with the average length of sampling time ranging from 97 to 341 minutes.

The air sample results for January 1 to March 31, and April 1 to June 30 are tabulated in Tables I and II respectively. An inspection of these tables shows that no significant changes occurred in any of the breathing zone (BZ) type samples. The weighted mean concentrations of Area "A" remained fairly constant. Weighted means computed for the GA type samples in Area 'B' decreased where enriched material is handled, and increased where normal uranium is handled. The decreased air concentration was expected since ventilating hoods were added to those operations which had been consistently high in the past. In some cases more general room ventilation was provided. The higher general air densities found where "normal" insoluble material is present is believed to be due to the great increase in the number of operations performed during the second quarter. In anticipation of such an occurrence, six inch flexible hose "drops" from an overhead ventilating duct were installed at intervals of six feet, to each machine. An investigation is being made of machine operations in an attempt to isolate those which contribute the most to air-borne uranium concentrations.

Urinalysis. A total of 1608 urine samples were analyzed for uranium, during the first quarter of the year. During the second quarter, 2122 urinalyses were performed. The increase of the second quarter reflects the expansion of Area 'B' operations. One third of the total samples in each period were analyzed for enriched uranium. The others were analyzed for normal uranium only. The urinalysis results are presented in accordance with the method used in previous Health Physics Reports. In Figures 1 and 2, the three percentiles, which were taken from working

TABLE I

AIR-BORNE URANIUM

Jan. 1 - March 31, 1951

Type of Material	ıterial	Origin	No. of Samples	Ave. Time of sample	Wt. Mean d/m/M ³	Type of Sample	Resp. Equipment
Normal Insoluble	soluble	Area "A"	. 23 66 34 64	27 30 83 72	403 40 546 18	BZ BZ GA	Yes No Yes No
Normal Insoluble	nsoluble	Area "B"	13 5	12 97	151	BZ GA	No
Enriched Soluble	Soluble	Area "B"	4 60 34	4 30 20	2176 93 121	BZ BZ GA	Yes No No
Enriched Insoluble	Insoluble	Area "B"	17 114 63	5 15 96	1429 3160 232	BZ BZ G A	Yes No No

TABLE II

AIR-BORNE URANIUM

Type of Material	Aaterial	Origin	No.of Samples	Ave. Time of Sample	Wt. Mean d/m/M ³	Type of Sample	Resp. Equipment
Normal	Normal Insoluble	Area "A"	30 54 23 75	19 15 79 83	529 35 36	BZ BZ GA GA	Yes No Yes No
Normal	Normal Insoluble	Area "B"	95 348	9 341	280	BZ GA	No No
Enriched	Enriched Soluble	Area "B"	12 77 37	18 15 321	3231 378 40	BZ BZ GA	Yes No No
Enriched	Enriched Insoluble	Area "B"	16 189 287	5 25 282	10,268 718 37	BZ BZ GA	Yes No No

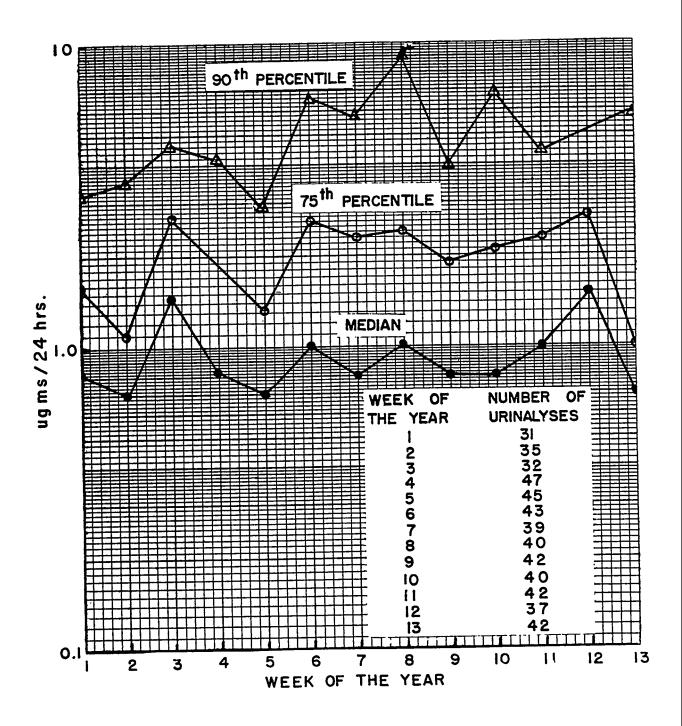


FIGURE 1. WEEKLY URINALYSIS NORMAL URANIUM AREA "A" FOR JAN, FEB, MARCH 1951.

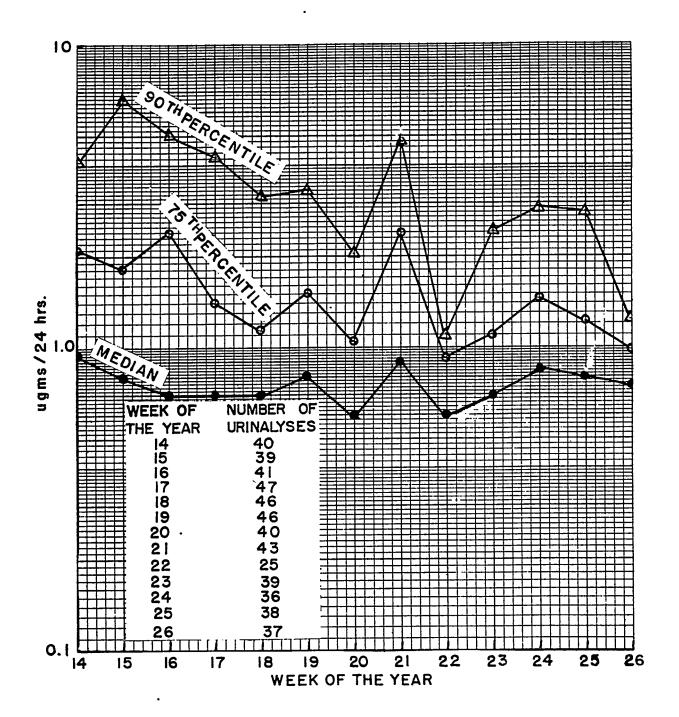


FIGURE 2. WEEKLY URINALYSIS NORMAL URANIUM AREA "A" FOR APRIL, MAY, JUNE 1951.

curves (cumulative percentage polygons) constructed on Area "A" employees, are graphed to show the relationship between the micrograms of uranium excreted and the week of the year. The data collected on Area "B" employees who submit monthly urine samples is plotted in terms of cumulative percentage polygons. The data are shown in Figures 3, 4, 5, and 6.

It should be noted that employees from Areas "A" (normal) and "B" (enriched) are exposed to air-borne dusts containing soluble and/or insoluble compounds of uranium, the particle size distribution of which remains unknown. Only the "Friday evening" type sample is collected due to a standard six day work week. As a consequence of the variation in the solubility of the inhaled compound, and in the process of sampling, rather large deviations in the analytical results occur from one sample to the next. Hence, interpretation of the polygons will not be attempted at this time for Area "A" employees (Figures 1 and 2) nor for Area "B" employees excreting enriched uranium (Figures 5 and 6).

Figures 3 and 4 contain polygons of the urinalysis results of employees from Area 'B" who submit monthly samples for a normal uranium determination. In Area 'B" inhalation exposures are limited to insoluble compounds, the most predominant of which appears to be uranium tritaoctoxide. The range of particle sizes is unknown.

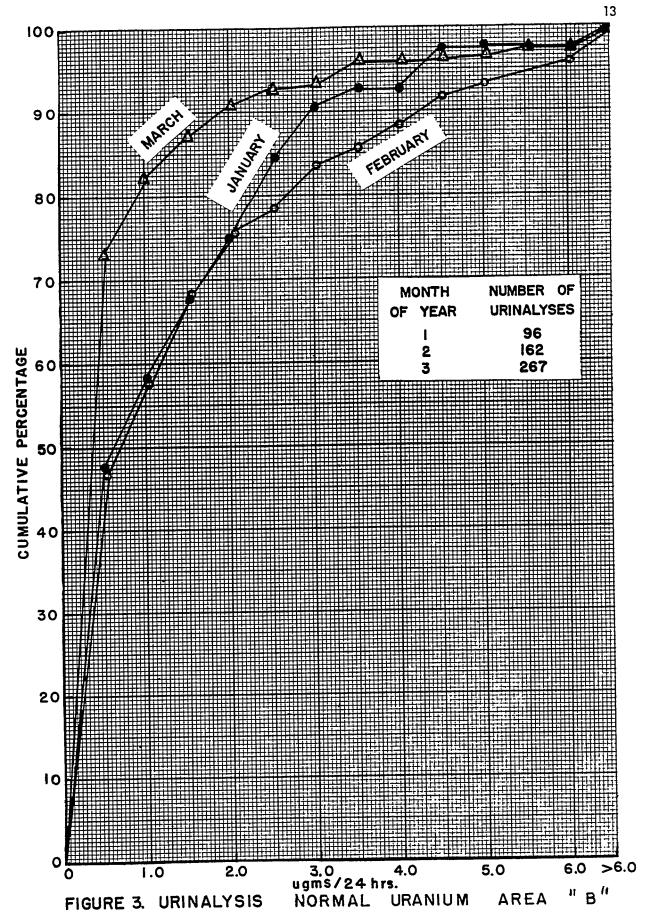
Here, as in Area "A", the "Friday evening" type sample is collected. This process of taking samples during working hours should have a negligible effect on the results since only insoluble compounds of uranium are involved in these inhalation exposures.

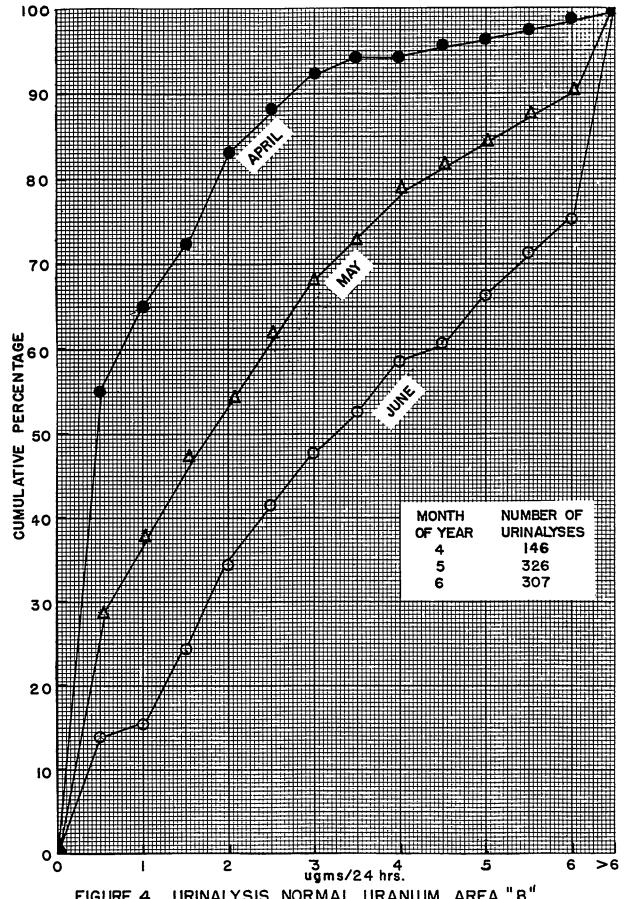
It will be observed from Figures 3 and 4 that for the first quarter no significant change occurred, but, during the second quarter a gradual increase in urinary uranium concentration is indicated. The polygon for the month of April is probably not representative since only 146 urinalyses are used in the plot. Approximately 300 urine samples should have been submitted for analysis, but a temporary cessation in collections reduced the number. During the succeeding months, the polygon approached the 75th percentile for the limit of 6 ugms.

No employee excreted more than 37 ugms per 24 hours during either the first or second quarter.

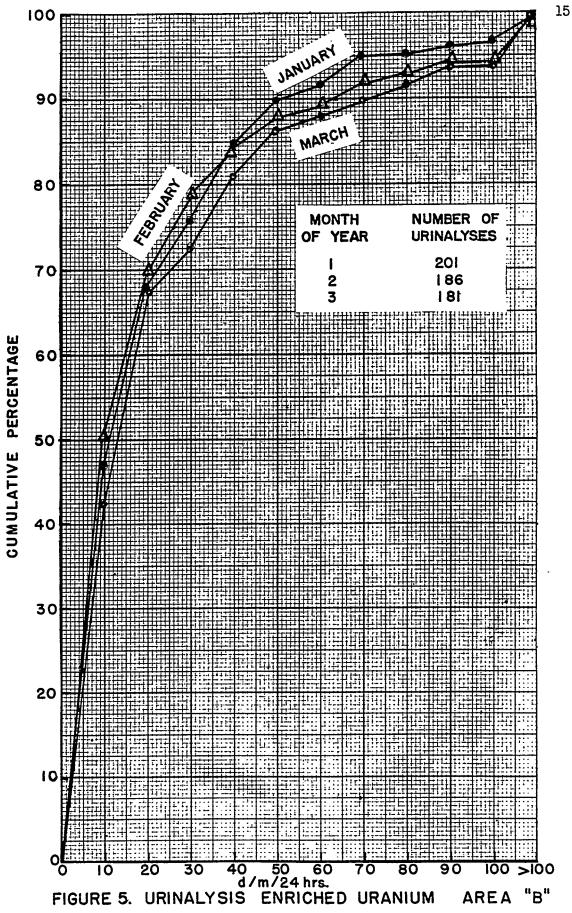
Plutonium

Facilities for the separation of Plutonium isotopes are as yet incomplete. It is estimated that the first plutonium "run" will not be made earlier than January 1, 1952.





URINALYSIS NORMAL URANIUM AREA "B"



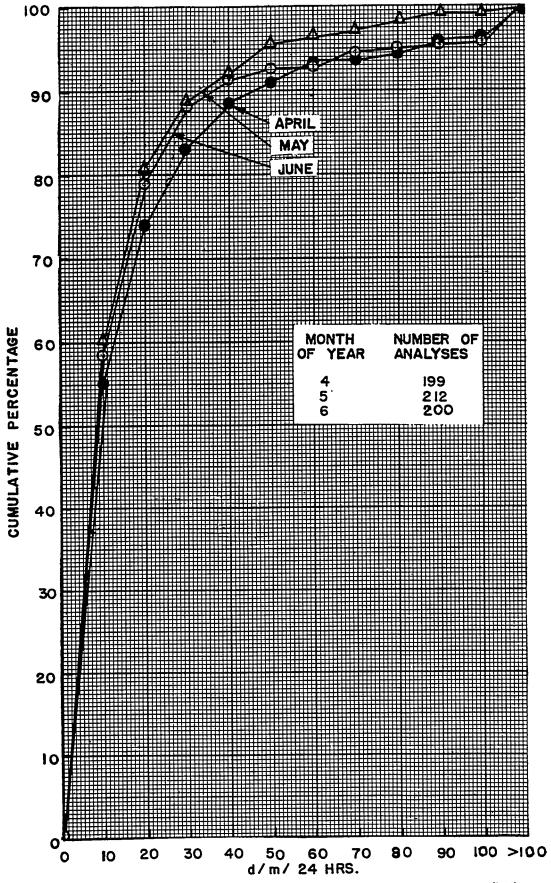


FIGURE 6. URINALYSIS ENRICHED URANIUM AREA "B"

Accelerators

86" Cyclotron. High beam currents resulting in target vaporization have caused the inside surface of the cyclotron to become grossly alpha contaminated. Under normal operating conditions this contamination remains inside the tank except for small amounts escaping through the vacuum lock during target changes or passing the cold traps and collecting in the pump oils. Only when the tank is open does this activity escape and become air-borne. Operations such as removing the dees or liner frequently causes the air-borne concentration to exceed the MPL. Respiratory equipment is worn during these operations.

Materials from the interior of the cyclotron are watched closely by the Health Physics Department to prevent the spread of contamination.

Persons working inside the cyclotron are required to wear protective clothing as well as respiratory equipment. This clothing is sent through a pre-wash before going to the central laundry.

Po - Be Spill

A Po-Be neutron source container ruptured, and the contents spilled in a large tank located in the Reactor Room of Building 9213. This tank together with the associated raise-lower mechanism, is shown in Figure 7. The accident occurred on March 27 during the course of an instrument calibration check. Fortunately, no one was seriously exposed, but, because it is always possible to learn something from the mistakes of others and because the consequences of this accident were reflected extensively in the activities of this department for a two month period following its occurrence, it is felt that a summary of the investigation should be included in this report. A more complete discussion of health physics and medical findings will be included in a completion report to be issued under separate cover. This summary is intended to focus attention on the accident and its immediate consequences.

Description of the Source. The source consisted of a 2 5/8" x 0. 23" O. D. X. 0.16" I. D. Be metal container (the inside of which had been exposed to volatilized Polonium), and 0.40 grams of 230-325 mesh Be powder. A 1/2", 8-32 male-threaded, slip-fit plug was inserted into the open end of the container and the entire assembly was sealed with a 0.010" thick nickel coating by thermal cracking of nickel carbonyl.

Neutron emission, by the ${}_4\mathrm{Be}^9$ (a,n) ${}_6\mathrm{C}^{12}$ reaction, on October 10,1950 was 3.18 x 10 7 n/second, the amount of Po on the same date being 15.93

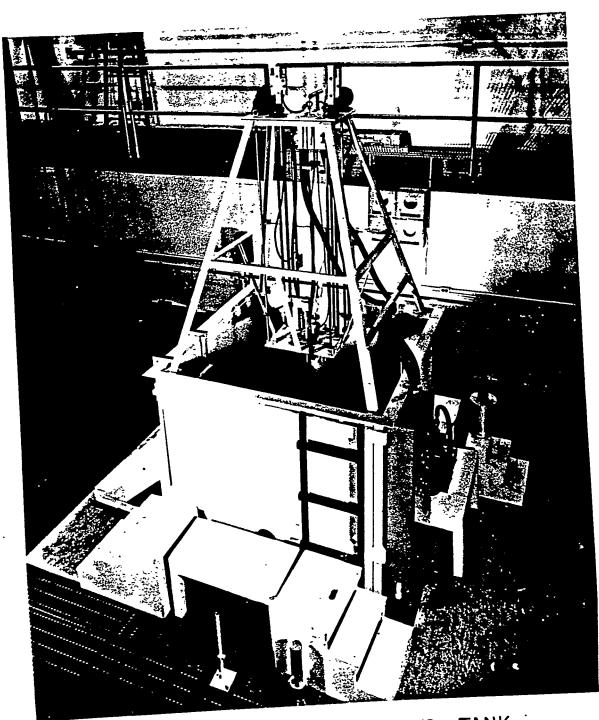


FIGURE 7. NEAR-CRITICAL ARRAYS TANK

determined that hands were grossly contaminated, the Maintenance Crew Group Leader entered the room to consult with . on matters pertaining to the drained window.

The maintenance workers completed the buffing operation, placed a plywood board over the window opening, and left the Reactor Room with a word to to the effect that their work on the window was finished. They proceeded to other work elsewhere in the building not knowing that an unusual occurrence had taken place. Meanwhile and his coworkers, having determined that his hands and shoes were grossly contaminated, decided that his shoes should be removed and left in the room and that they should proceed to a small laboratory a short distance down the corridor where they would attempt to decontaminate—hands. The time consumed to this point was of the order of 10 - 12 minutes.

Immediate Consequences of the Accident. During the next fifteen minutes the seriousness of the accident was brought to light following repeated hand washes with 6N HCl, 6N H₂SO₄, 8 per cent NaClO, and 25 per cent Na₂CO₃ with Tergital, each with limited success, and with the discovery that was grossly contaminated from head to foot. Activities in excess of 30,000 d/min. were measured in his hair and on several locations of his protective clothing. A nose swab showed total activity approaching 15,000 d/min. (Nasal irrigation later by a Plant Physician gave an additional 7000 d/min.). Finally, the building supervisor was notified and the lengthy job (two months) of decontaminating the building and determining the extent of the exposures was begun.

Following notification of the building supervisor and subsequent notification of the Health Physics Department, these procedures were effected in the approximate order listed.

- 1. All electrical circuits to the Reactor Room were shut off.

 This stopped the circulating air heaters and air exhaust fans.
- All personnel known to have been in or near the Reactor Room were checked for evidence of contamination and decontaminated if necessary. Within a period of 2 hours, all had reported to the Medical Department.
- 3. The building supervisor, with the aid of a gas mask and an impermeable suit, entered the Reactor Room, placed the source container in a sealed sample bottle, and removed an air sample filter from an air sampler that had been operating.
- 4. The doors to the Reactor Room and Control Room were locked and sealed with masking tape.

- 5. All detectable contamination in rooms and corridors other than the Reactor and Control Rooms was removed. The floors involved were, for the most part, vinylite plastic covered. Removal of the wax coating and, in some cases, a layer of the plastic with acetone proved most successful. Concrete was best cleaned by abrasion. This activity required several days.
- 6. All surfaces in the Reactor Room tank and equipment (ion chambers, uranium slugs, etc.) were sealed with pressure tape or in polyvinyl chloride bags in an effort to immobilize the polonium spread over the tank and its contents. During the course of this work, which required several days, measurements of air-borne activity varied between 2300 and 3900 d/min/M³ making it necessary for personnel to wear Army Assault Masks and disposable protective clothing.
- 7. For a period of several hours, unfiltered air from the room in which the spill occurred was exhausted to the atmosphere. An exhaust system of approximately 20,000 cfm capacity had been provided for just such an emergency. The remote location of Bldg. 9213 permitted the use of this measure.
- 8. All contaminated items were removed from the Reactor Room for disposal or decontamination and heavy equipment such as expanded metal flooring, I beams, and the steel tank were removed to the exterior of the building, sand blasted, and repainted. This work extended over a period of several weeks.

The limits of surface contamination at the conclusion of the decontamination effort were 250 c/min over 13 in² with zero wipe. An exception was that of the aluminum canned slugs which were cleaned to a point where 500 c/min, or less, could be wiped from the surface.

Conclusions. There is no known satisfactory way of decontaminating metals without removing surface layers. For example, the aluminum clad uranium slugs were ineffectively scrubbed with water, scouring powder, and a brush. Surface layers of aluminum carrying the contamination could be removed with 1:1 HNO₃. Caustic soda, sodium carbonate and dilute H_2SO_4 attacked the aluminum but the polonium was not removed. Electrolysis in H_2SO_4 with 0.2% HF, using the contaminated object as the anode with a large area cathode, seemed to decontaminate but the process was slow. The current density was about 1 ampere/ft² of anode and was adjusted until gas was evolved at the cathode. Rough items, such as the steel tank, had to be sand blasted and repainted. The metal screens of radiation survey instruments were anodically cleaned in a mild bath of oxalic or citric acid.

It is believed that the clean-up would have been more effective had the initial effort been directed towards an immediate immobilization of the gross contamination in the steel tank. As it developed, the immediate effort was concerned with cleaning up what had spread to other parts of the building while the Reactor Room was left sealed for several days to await the convenience of the contamination crew.

As a preventative measure against the reoccurrence of such an accident, it is suggested that all source capsules should be enclosed in a suitable metal container which can be sealed.

III. EXTERNAL RADIATION HAZARDS

(L. C. Emerson)

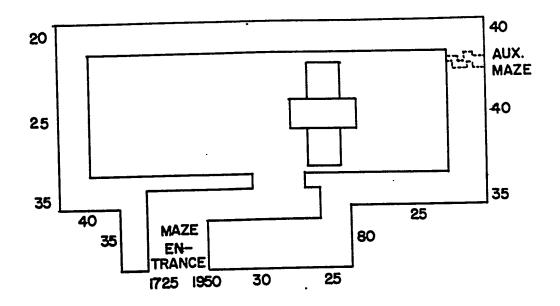
Accelerators

Van de Graaff. Under normal conditions the radiation flux from the 5 Mev Van de Graaff is so low that it imposes few restrictions on activities in the operating area. The neutron flux at the control panel is well below the MPL even for thick target bombardments. Fluxes as high as 560 neutrons/cm²/sec have been measured at a point close to the target in the mass one beam. X-rays from the top of the Van de Graaff are usually below 10 mr/hr. However, X-rays may increase to over 1 r/hr under poor vacuum conditions. High radiation fields are well marked, and the working times in these areas are limited. There have been no cases of radiation over-exposure at the Van de Graaff Laboratory.

86" Cyclotron. Increased cyclotron innage has resulted in greatly increased residual target activity. It is not uncommon for the residual activity to reach a value of 25 r/hr at a point three feet from the target. This virtually eliminates the possibility of removing a target without becoming over-exposed. To facilitate target changes without losing tank vacuum, a remotely controlled target dolly was constructed and is used in conjunction with a vacuum lock. With this equipment the entire operation of transferring a target from the cyclotron to a lead carrying box can be performed from a safe distance.

A survey of the neutron flux outside the cyclotron shield was made with a U^{235} fission chamber. The location of the flux values in neutrons/cm²/sec are shown in Figure 8. These values were normalized to a 70 μ a beam of 15 Mev protons on a beryllium target. It is planned to reduce the high fluxes at the maze entrance with a sliding shield which will cover the opening. Gamma radiation outside the shield is below the MPL.

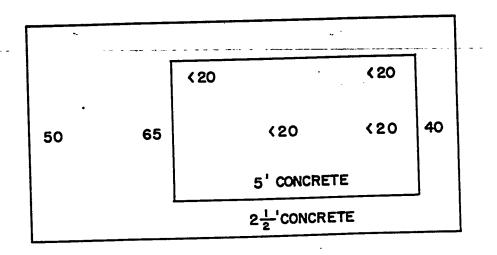
A system of medical control has been inaugurated whereby every person who works at the cyclotron will undergo periodic eye examinations. The examinations are performed by an eye specialist and consist of an extensive initial examination of the eye followed by monthly slitlamp inspections.



FIRST FLOOR SHIELDING

VALUES SHOWN ARE IN NEUTRONS PER SQUARE

CENTIMETER PER SECOND



ROOF SHIELDING

FIGURE 8. NEUTRON SURVEY OF 86" CYCLOTRON SHIELDING

Personnel Monitoring

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During the interval covered by this report a total of 31,323 film meters were processed of which the total for the first quarter was 1402 badges and 10,019 rings and during the second quarter 1533 badges and 18,369 rings. A total of 124 people were supplied with gamma sensitive pocket chambers and 88 people with thermal neutron sensitive chambers on a daily basis.

Plastic Ring Conversion. Monitoring beta radiation in the presence of weak gamma radiation is a special problem in this department. Due to the localized nature of the exposure, rubber finger rings are provided for more than 300 people. The fact that the ring can be worn only one day creates a number of handling problems. The rings must be assembled, X-ray identified, distributed, and collected daily. Ring film must be photographically processed, the exposure interpreted, and the film filed. Records must also be kept. This processing would not be too difficult for a small aggregate of rings but since the number involved is large and increasing daily (a 30% increase will be effected shortly) a different system is strongly indicated. After a careful investigation of the situation, the decision was made to convert from rubber film rings to plastic film rings. An initial economy will be realized by such a conversion. Rubber rings are used for one day only whereas plastic rings can be changed weekly. The time saving is estimated to be 15 - 25%. A plastic ring re-design was necessary to meet the X-ray identification specifications which have been set up by this department.

Figure 9 shows the proposed ring and parts. A screw cap will be incorporated for ease in assembling. To enable X-ray identification of the film in the ring, the film will be placed in the pad in the darkroom, and the pad closed. Badge number and date will be X-rayed from lead figures located on the outside of the pad. After identification, the pad will be cemented to the ring base to form the completed ring meter. Outside identification of the ring will consist of impressing the wearer's badge number onto the ring with steel dies.

Area Monitoring

Sewer Analysis. The results of the continuous water sampling done at the outlet end of the Y-12 storm sewer are shown in Table III. There were no significant changes in the level of activity during the period.

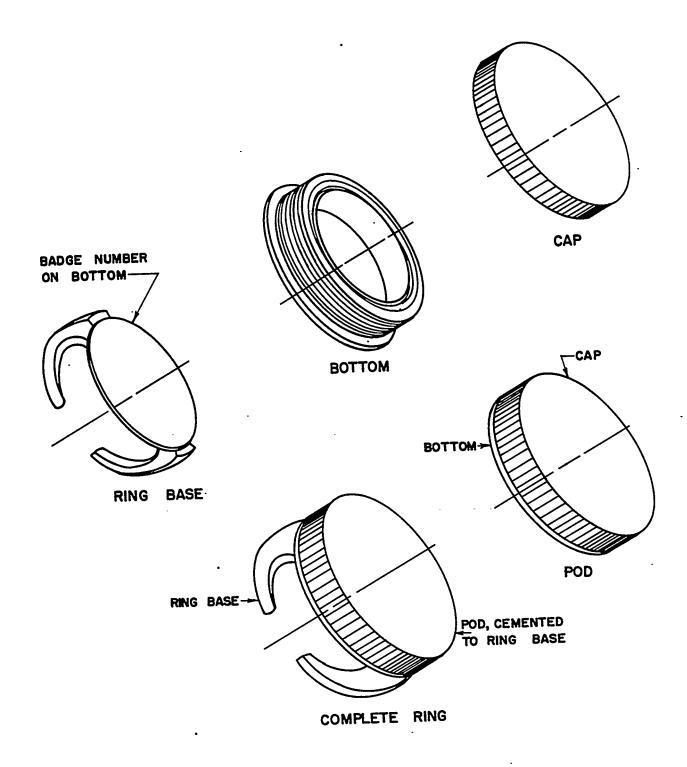


FIGURE 9. CONVERSION RING

TABLE III .

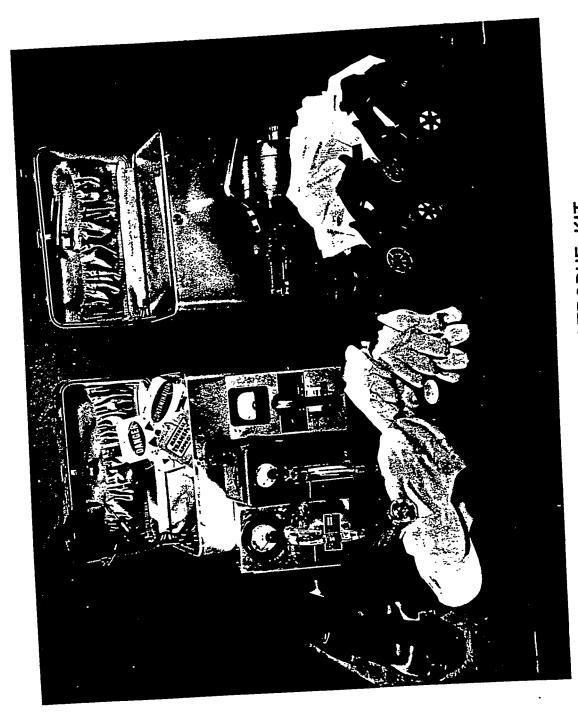
STORM SEWER ANALYSIS

	No. of Weekly Samples	pН	Uranium in ugms/100 ml	Uranium in c/min/100 ml
Month	/	7.3	0.65	0.86
January	4		0.40	0 .41
February	4	7.4	0.49	0.16
March	5	7.5	0.22	
April	4	7.1	0.27	0.11
-	4	7.2	0.40	0.18
May	•	7.4	0.25	0.11
June	4	in	0.38	x2= 0.30

Area Map. An area map designed to show the location of the buildings and/or areas known or assumed to be potential health hazards was issued during the period. Buildings where processing operations are carried out; buildings where toxic materials are handled; and buildings where the past history of use placed them in either of the above catewhere the past history of use placed them in either of the above categories, are classified as potential health hazards. Areas used for the storage of toxic material and contaminated materials and/or equipment are similarly classified.

Catastrophe Kits. The disaster kits discussed in Report Y-780, were consolidated to provide one master kit as shown in Figure 10 which is kept at the main offices of the Health Physics Department and a second smaller unit kept at the Critical Experiments Laboratory, Bldg. 9213. The latter has the following items included:

(a) 2 each (b) 2 each (c) 2 each (d) 3 pairs (e) 2 pairs (f) 1 pair (g) 2 sets (h) 1 each	Caps Respirators Flashlights Gloves, canvas Rubbers Shoe covers, cotton Refills for respirators High range Alpha, Beta, Gamma Survey meter GM Survey meter, 0-20 mr/hr
(i) leach (j) lset	Batteries, flashlight



Air Sampling

Permanent Air Samplers. Twenty-two permanent type air samplers were installed in Area ¹B¹¹ during the period. The addition of this group of samplers has resulted in an increased volume of general air samples with a subsequent increase in the counting load.

Air Samples. For some time it had been recognized that a special air sample carrying case was needed in order to minimize the probability of sample contamination and to provide a means of transporting samples in such a way that loosely deposited materials would not be lost from the filter paper. In addition, the carrying case should fill the following requirements: (1) strong and durable with minimum weight; (2) easy to decontaminate; and (3) provide adequate space for such auxiliary items as seem desirable. The details of the selected design and the included items are shown in Figure 11. In addition to space for twenty sample heads and data cards, spaces are provided for (1) a box of tissue paper for decontamination and cleaning needs on the job, (2) extra sample papers and (3) small hand tools for minor sampler repairs, tweezers for the removal of sample papers and a small brush for cleaning rotameters of air metering devices. The box is constructed of 1/4" lucite with stainless steel cover and is loaded from the sides. Sample heads after use are suspended from the shelves in such a way that the open end of the sample head is in the "up" position. This prevents the loss of loosely deposited material from the filter paper. Unused heads, for purposes of quick, positive identification, are carried with the paper collection face in the down" position. The carrier fully loaded weighs approximately 23 lbs.

Equipment and Materials Inspection

Shipments. During the period covered by this report a total of 836 shipments were inspected for radiation and contamination. 131 shipments or 15.7% were contaminated.

Transfers. No accurate count was kept of the total number of intradepartmental transfers of materials and/or equipment which required inspection by the Health Physics Department.

Surplus Clothing. The practice of inspecting items of clothing to be disposed of by the Salvage Department was continued on a routine weekly basis. Approximately 5000 pieces of salvage clothing were inspected.

FIGURE II. AIR SAMPLE CARRIER

Other Surveys. Plans to survey the individual buildings in the potential hazardous group (referred to elsewhere in the Area Monitoring section of this report) were deferred to some future date when the press of routine work has abated or sufficient men are available to permit this work to proceed. The special surveys made at the cyclotron and criticality buildings are discussed in other sections of this report.

V. INDUSTRIAL HYGIENE

(W. H. Baumann)

Beryllium

Beryllium Handling Facilities. The Beryllium Machine Shop, located in Building 9766, was utilized during the period mainly for machining of non-toxic metals. Only small amounts of beryllium metal were handled. The control program was not relaxed during this transition period, however. A rather extensive beryllium fabrication project is planned in the near future for this shop. Machining facilities have been expanded to include handling of other metals since the shop cannot be maintained exclusively for the fabrication of beryllium and its compounds.

Beryllium is handled in small amounts in a greater diversity of operations and locations. Individuals responsible for the handling of beryllium and its compounds consult this department before proceeding; hence, the air analysis program can keep abreast with expansion.

The construction of analytical facilities for handling of beryllium compounds, mentioned in Health Physics Progress Report Y-780, was discontinued temporarily during the first half of 1951. Work on this project has, however, been resumed recently since the additional facilities are now urgently needed.

Air Analysis. Beryllium air findings for the first and second quarters of 1951 in the Machine Shop are compiled in Tables IV and V. Air analyses for beryllium, including all types of samples, totaled 845 for the 2nd Quarter. The averages which are reported for each area, excluding operational and breathing zone samples, were considerably lower for the 1st quarter of 1951 than similar averages for the 4th quarter of 1950. This diminution is evinced further in averages similarly compiled in Tables IV and V. The obvious explanation lies in the reduced amounts of beryllium handled. The operational and breathing zone average shown in Table V is above the MPL of 2 ugm/M³ because of the occurrence of two high findings of 43 and 27 ugm/M³. The offending operation was modified immediately by employing equipment of improved design.

Abnormally high findings were recorded at one of the analytical laboratories as shown in Table IV. These findings were obtained within a chemical fume-hood where experimental equipment was installed. The analyses were made to convince the experimenter that beryllium was

TABLE IV

BERYLLIUM AIR ANALYSES, 1ST QUARTER, 1951

	J.		Number of	Beryllium	Beryllium Air Concentration ugm/M ³	lon ugm/M³
Area	sample	Location	Analyses	Minimum	Maximum	Average
Beryllium .	General Room	Locker Room	54	< 0.0001	0,05	0,016
Machine	Atmosphere	Machine Shop	415	0,0001	0.20	0.019
Shop, Building 9766		Tool Grinding Area	99	0,0004	0.20	0.016
		Storage Room	59	0,0005	0.20	0.029
	Operational and Breathing Zone		35	0.02	16.0	1.24
	Filter House	Influent	61	90000	0.40	0,051
		Effluent	79	< 0,0001	0.02	100.0
	Outdoor	500' ENE of Stack	49	<0.0001	0.0003	< 0.0001
		500' WSW of Stack	44	<0.0001	0,001	0,0001
Building 9213	Operational and Breathing Zone		Ľ	6.024	3.2	0.64
Building 9201-2	Operational	Cyclotron Area	8	< 0.0001	0.004	0.001
Room 1, Building 9733-2	Operational and Breathing Zonę	Analytical Laboratory	ھ	0.009	45.0	10.5
Building 9766	Operational and Breathing Zone	Material Testing Lab.	1			0.02

TABLE V

	BERY	BERYLLIUM AIR ANALYSES, 2ND QUARTER, 1951	2ND QUARTER,	1951		
	Then of		Number of	Beryllium Air	Beryllium Air Concentration ${ m ugm/M}^3$	§ш/М ³
Area	Sample	Location	Analyses	Minimum	Maximum	Average
Beryllium	General Room	Locker Room	99	< 0.0001	0.04	0.008
Machine	Atmosphere	Machine Shop	469	< 0.0001	0.3	0.008
Shop, Building 9766		Tool Grinding Area	62	0.0002	0.2	0.009
		Storage Room	63	€ 0.0001	0.17	0.005
	Operational and Breathing Zone		18	0,004	43.0	4.08
	Filter House	Influent	89	9000.0	0.2	0.02
		Effluent	63	< 0.0001	0.2	0.004
	Outdoor	500' ENE of Stack	24	< 0.0001	0.002	0.0001
		500' WSW of Stack	21	<0.0001	0.0002	< 0.0001
Building 9733-1, Room 4	Operational and Breathing Zone	Spectrographic Laboratory	8	0.004	0.015	0.009
Building 9733-2, Room 1	Operational and Breathing Zone	Analytical Laboratory	9	Z00 ° 0	0.12	0.03
Building 9766	General Room Atmosphere	Metallurgical Laboratory	4	0.004	0.04	0.02

emitted from the equipment in an effort to discontinue the unsafe practice of working within the confines of the hood. Results of samples taken outside the hood were well below the MPL of 2 ugm/M^3 .

Beryllium contamination arising from other operations in areas listed in these tables were well within the MPL.

Other Contaminants

Air Analysis. Results of other contaminants sampled during the first half of 1951 are compiled in Table VI. No attempt was made to tabulate individual findings; however, air analyses in excess of the MPL are classified as positive and the number of positive results are listed. Air analyses for phosgene, hydrogen sulfide, and mercury totaled 8, 5, and 76 respectively, with no positive findings recorded for the first two contaminents. Twenty positive results were found for mercury. These findings indicate excessive surface contamination and poor housekeeping; for, the general level of mercury vapor contamination was well within the MPL for the operations investigated.

Other Activities

Filter Paper Evaluation. A program is underway to evaluate filter papers used for the field sampling of particulate contamination. At the present time, this department employs Whatman papers No. 42 and No. 44 with a standard filter paper adapter (1" i. d.) in conjunction with equipment which was illustrated and described in Health Physics Report Y-780. The project was initiated in the latter part of June and results are inconclusive at this time.

The pressure drop across filter papers was checked using a Gast Pump and rotameter as employed in field sampling. It was found that the resistance across clean Whatman papers No. 42, No. 44 and No. 41 was 16.6, 6.2, and 0.47 inches of mercury (gage) respectively at an air flow rate delivered by the Gast Pump when using No. 42 paper; hence, the other papers were compared at the same volumetric rate. Both No.'s 42 and 44 papers have high resistance and plug rather rapidly which tends to reduce the volume of air which can be aspirated through the papers during sampling. It might be added that No.'s 42 and 44 papers were evaluated previously for penetration using the CWS D. O. P. apparatus and were found to have extremely low penetration, however, the inherent high initial resistance coupled with the rapid resistance build up with plugging detracts from the suitability of these papers for routine air sampling.

TABLE VI

CONTAMINANT-AIR ANALYSES, 1ST AND 2ND QUARTERS, 1951

					version of Description	
Contaminant	Area	Operation	Maximum Permissible Limit	Number of Analyses	Analyses	Remarks
Phosgene	Building 9211	Chlorination				
		Zirconium	1 P.P.M.*	&	0	
Hydrogen		Zírconíum				
Sulfide	Building 9206	Process	20 P.P.M.	5	0	
Mercury	Building 9733-1	Spectrographic				
	Room 4	Analyses	0.1 mg/M ³	8	-	
	Building 9201-3	Cleaning mercury				
	Van de Graff	Diffusion				No source
-		Pumps		30	12	Ventilation
	Building 9733-1,	Mercury cells.				Good
	Room 19	General Atm.			··	General
		Concentrated		16	8	Ventilation
	Building 9733-2,	Mercury cells.		-		Good
	Room 1	General Atm.				General
		Concentrated		12	5	Ventilation
	Building 9403-1	Filling				
		Manometer		10	0	

* p.p.M. - Parts per million parts of air, by volume.

When high resistance papers were used the air volume control valve should be located on the upstream side of the rotameter in order not to affect rotameter calibration. If the valve is placed on the downstream side of the rotameter, high resistance coupled with varying back pressure will influence rotameter calibrations, especially if the rotameter is calibrated against free air.

Air Sampler Modification. The permanent type air sampler, described in Health Physics Progress Report Y-780, is employed in many areas to collect an integrated sample over a full operating shift for the purpose of determining the general level of contamination. In dusty atmospheres, filter papers plug readily and the air volume rate, as indicated by the rotameter, decreases. In general these samplers are unattended throughout a shift and the reduction in air flow may be considerable unless the flow control valve is readjusted.

The permanent type unit was modified, as shown in Figure 12, to alleviate this condition by installing a constant differential type flow controller. Some preliminary tests were made with the modified sampler and it was found that the plummet in the rotameter remained at a fixed height regardless of the degree of plugging of the filter paper. The flow controller is relatively inexpensive and can be incorporated into the commercially procured sampler with a few machining alterations. A sampler of this type will have application in dusty environments where long term samples are collected with minimum operation attention.

Iso-Kinetic Sampler. The Plutonium Laboratory, which is under construction, requires extensive ventilation facilities including a highly efficient air cleaner. It was decided to monitor the effluent air from the cleaner for radioactive particulate contamination by installing a fixed sampler in the discharge piping. It is very important in obtaining a representative sample of dust from a gas stream that the velocity through the sampler be the same as the velocity of the gas passing the tube. When the two velocities are the same, sampling is iso-kinetic and the device is referred to as an iso-kinetic sampler.

The sampler assembly that is to be installed in the ventilation piping is shown in Figure 13. Several nozzles of varying aperture were made up from the drawing shown in Figure 13. The conventional filter paper adapter is fixed outside the piping to facilitate routine changing of papers for analysis of contamination. Air will be metered through a rotameter and moved with a pump. The sampling station will be at the duct centerline and sampling velocity will be changed by using a proper sized nozzle opening. When the sampler is not in use, a blank adapter base will be connected to the assembly. The apparatus may be removed from the duct for decontamination.



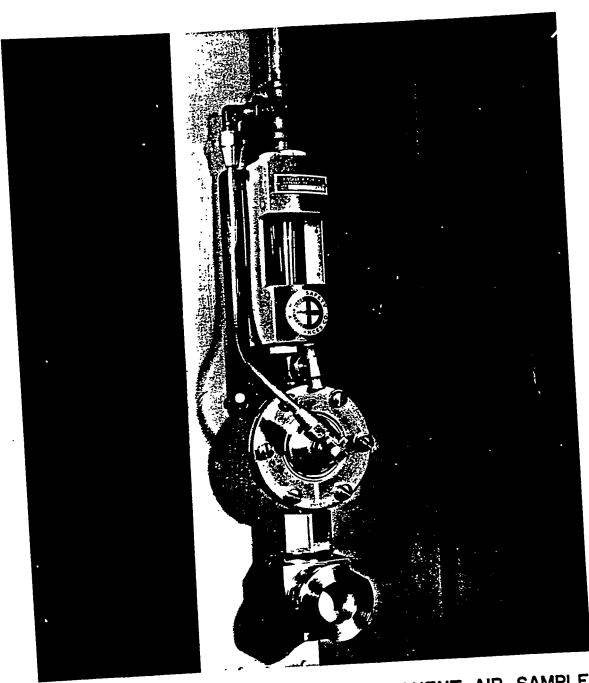


FIGURE 12. FLOW CONTROLLED PERMANENT AIR SAMPLER

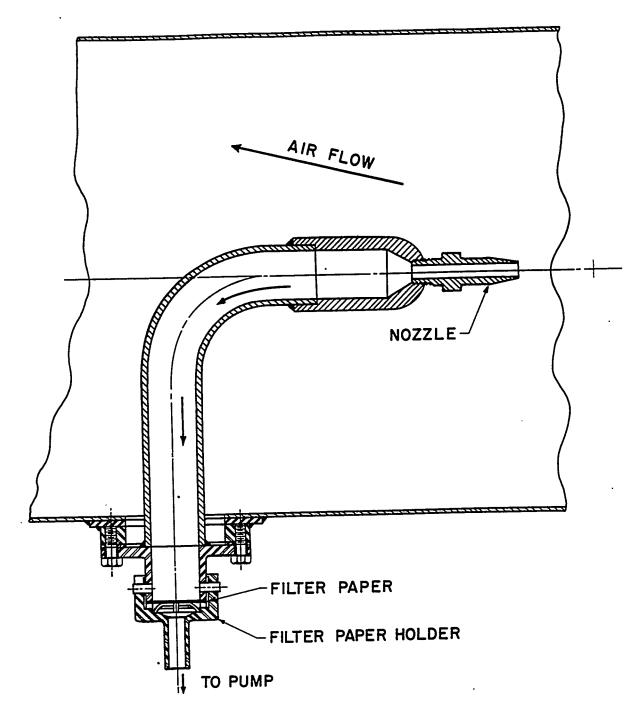


FIGURE 13. ISO-KINETIC SAMPLER ASSEM.

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E. G. Strumess

CAUTION

To a programme of feeting the community of the c

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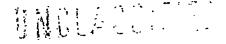
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9.	Dr. P. D. Scofield
10.	Dr. A. Kammer
11.	Dr. E. D. Shipley
12.	Mr. E. G. Struxness
13.	Mr. John Morfitt
	C. R. I. O.

Central Reports and Information Office

Date Issued: JUL 11 1343







HEALTH PHYSICS - HYGIENE PROGRESS REPORT

May 1 - 31, 1949

Part I - Introduction

General

With the inauguration of an effort to investigate the Calutron as a source of D-D neutrons by the Beta Development Group in Building 9204-3, the problem of monitoring personnel exposures to neutrons has developed. As a temporary expedient, we are using alpha sensitive film provided by the Health Physics Division of ORNL. They also develop the film and count the tracks. Because of the laborious procedures involved in this method of monitoring, plans are being made to employ some secondary reaction to neutron bombardment that will produce an effect on film density, which can be measured more easily and accurately.

Approval has been granted by the AEC for the building of our calibration shack to be known as the Instrument Testing Station. All building and equipment design has been completed and construction is slowly getting underway. It is hoped that the completed structure will be ready for occupancy by September 1, 1949.

A power supply (30 amps at 28 volts) and control panel for eight electroplating cells has been designed and is being built for use in plating urine and fecal uranium concentrates. This equipment will be located in the Health Physics Laboratory of Building 9706-2.

Work is progressing on the design and construction of low rate air samplers and the "dummy" respirator which is to be used in connection with proposed toxicological studies.

Part II - Health Physics

Routine Surveys

1. Air Surveys

A total of 72 samples of air-borne uranium were taken in 13 different work locations during the period. Approximately 18% of these samples gave concentrations in excess of 150 Mg/M3 while 0% indicated concentrations exceeding an activity of 1225 d/Min/M3. Table I shows the locations, process operation and range in measured concentrations of those samples taken during the period.

2. Water Surveys

(a) Potable Water

Samples were taken during the period but have not been returned from the Laboratory due to the decreased activity caused by the vacation schedule.





(b) Storm Sewer

		analyses*		
	Uranium	Alpha Count	Total Acid	ity-CaCO,
Sample No.	ppm	per 100 ml.	. ppm**	рН
113	•015	•22	86	7.8
114	.021	.47	89	7.7
115	•019	2.1	102	8.0
116	.015	.8	75	7.7
117	•020	1.8	97	7.5
118	.022	.83	100	8.1

(c) Sanitary Sewer

		Analyses*		
	Uranium	Alpha Count	Total Acid	ity-CaCO3
Sample No.	ppm	per 100 ml.	ppm**	рН
105	.013	•64	103	7.2
106	.027	•93	7.4	6.0
107	.021	2.9	114	7.2
108	.034	12.8	75	6.7
109	•025	2.9	100	7.3
110	.056	1.18	85	7.2

3. Site Surveys

(a) Building 9206 - Contaminated Drums

Approximately 250 empty contaminated wood and metal drums were moved from Bldg. 9206 to the X-10 Burial Ground.

(b) Building 9204-3 - Contaminated Brick and Sinks

Approximately 16 barrels of contaminated brick and several sinks were moved to the X-10 Burial Ground.

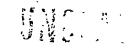
(c) Salvage Yard - Contaminated Material

One lot of miscellaneous truck beds, cabs, chassis, etc. were moved to the X-10 Burial Ground.

(d) Buildings 9201-1, -2, -3 - Silver Bus Bars

The program to remove silver bus bars from Buildings 9201-1, -2, and -3 has been initiated. Upon removal from the track the bus bars are first vacuumed to remove dust, cut into desired lengths, washed in a calgon-soda solution, checked for radioactive contamination, and packed for shipment when contamination cannot be detected by survey meters and smears.





^{*}Based on a confidence level of 95%.

^{**0.0} ppm = pH 7.0



4. Shipment Surveys

Two hundred and twenty-four lots of shipments were checked for alpha, beta and/or gamma activity in accordance with Standard Practice Procedure #20-A for release of property for shipment from the Y-12 Area.

B. Special Studies

1. Electroplating of Minute Quantities of Enhanced Uranium

The engineering has been completed on an 8 cell electroplating unit to be installed in the laboratory for the detection of very small quantities of enhanced uranium. This unit will contain 8 glass cells with individual water baths, hot plates and stirrer motors. The power will be supplied by two battery chargers having a total output of 30 amperes and 28 volts. A six foot panel will contain individual voltmeters, electrical outlets, on-off switches for the hot plates and stirrer motors, and electrodes for applying the voltage to the cells.

2. Amino Acid Nitrogen-Creatinine Ratio

The Folin-Wu method for the determination of creatinine and the copper method for the determination of amino acid nitrogen have been calibrated.

The amino acid nitrogen-creatinine ratio for early morning, afternoon and 24 hour samples was studied over a period of 5 days. In the case of each of the three people tested the afternoon ratio was significantly different from either the early morning or the 24 hour sample. This information makes the collection of samples at the same time each day essential.

3. Air Sampling Methods

Three air samplers are being designed. These samplers will use filter paper 1 5/32 inches in diameter, the same size used by the Cascade Impactor. Rotometers will be used to monitor air flow, a commercial Rotometer being cut down from 12 inches in length to approximately 4 inches. The pumps for the air samplers and associated equipment can also be used with the Cascade Impactor.

A respirator filter tester is being constructed which will be capable of testing the respirator filters used in the area. The Cascade Impactor and a filter paper trap back up the respirator thus permitting particle size and concentration determinations of the material which passes through the filter.

4. Decontamination Study

Dr. C. E. Larson has suggested the possible use of Calgon and Nullapon as complexing agents in decontaminating hands, clothing and equipment. To investigate this possibility in relation to a similar study of other agents made by A. B. Carlson, a test method has been devised.* Four types of cloth

^{*}Carlson, A.B., "The Removal of Uranium Compounds from Cloth," Report # M-3322, University of Rochester, 1946.





will be impregnated with two each water soluble and water insoluble uranium compounds. An effort will then be made to determine the relative effectiveness of aqueous solutions of these complexing agents in removing the compounds from the cloth.

Work has progressed to a point where all cloth samples have been impregnated and the method of analysis (Ascorbic Acid Colorimetric Method) has been established and calibrated.

C. Personnel Monitoring

1. Alpha Hand Counts*

Hand Count Totals, April 1 - 30, 1949

	Total Left	Total Right	Total Left Hand	Total Right Hand
		Hand Counts	Above-tolerance Counts	Above-tolerance Counts
Al4J	1	1	0	0
Al4N	54	54	7	8
Al6N	3 8	3 8	О.	0
A20N	403	403	2	0
B12L	1418	1418	4 80 ·	504
H12D	, 5	5	2	2
H12E	365	365	23	34
M12P	6385	6385	3033	3133
M15P	1082	1082	83	100

Totals	9,751	9,751	3,630	3,781

2. Personnel Meters

A total of 102 film badges worn by personnel in the Assay Laboratories, Radiography Shop, Spectrograph Laboratory and "Metal" Machine Shops were processed during the period. The total number of pen chamber readings recorded was 868. None of these gave indications of exposure in excess of 50 mr per day.

A total of 1,703 finger film pads were worn during the month by 109 persons in C-1 and D wings of Bldg. 9212, Radiography Shop, Room 17, Bldg. 9206 and Pilot Plant, Bldg. 9206. Two hundred and seventy-four of these pads showed detectable exposure of less than 100 mrep during one work shift. Fifty-six showed exposures in excess of 100 mrep during one work shift, the greatest exposure being 510 mrep. One hundred and five pads were light struck or otherwise damaged so that the film could not be read.

Thirty-one ring badges were worn by 9 persons. None of these gave indications of exposure in excess of 50 mr per day.

Four plastic rings were worn by one person. None of these gave indications of exposure in excess of 50 mr per day.

^{*}It is to be noted that these recorded counts (at least two per day at times when the hands are known to be grossly contaminated, i.e., just before lunch and at the end of the work shift) do not represent the degree of hand contamination at times when personnel leave the work area for lunch and/or when they leave the plant at the end of the work day. Operating procedures provide, with certainty for adequate decontamination before personnel are permitted to leave. Many hand counts are therefore not recorded.

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Fifty-seven neutron badges were worn by personnel in Bldg. 9204-3. None of these gave indications of exposure in excess of 30 mrep per week. (Eight hour day, five day week.)

3. Neutron Film Monitoring

A procedure is being set up to monitor neutrons using Eastman "K" film and neutron shields. This work is based on work done at the University of Rochester by G. Dessaner and E. Lennox. A polonium-beryllium neutron source on loan from K-25 is at present being used for calibration of the films. It is planned to have a small neutron source permanently available to this department for calibration purposes when the Instrument Testing Station is completed.

Part III - Instrumentation and Calibration

A. Instruments on Order

One (1) Chang and Eng Fast Neutron Monitor

One (1) Kelley-Koett Alpha-Beta-Gamma Electroscope

Two (2) Kelley-Koett Alpha Counter Scaler with Parallel Plate Counter and Amplifier

Part IV - Industrial Hygiene

A. General

The M.S.A. Benzol Indicator is still in the shop. A G.E. Electronic Hg Vapor Detector is on order.

Analytical methods for cyanides is still in the process of development.

B. Surveys

1. Site Surveys

A total of 145 samples were taken of air-borne contaminants. Table II shows the locations, process operation, protective measures and range of measured concentrations obtained in these samples.

Out of 145 samples 28 were found to be above tolerance. The following is a breakdown of the above tolerance samples:

Contaminant	Building	No. of Sample	s Above M.A.C.
Beryllium	9731		6*
		Gen.Air or Breath.	Work or Source Level**
Mercury Vapor	9203 9211 9720 - 5	2	5 1 2
	9731 9733 – 3	1	2 3 4
	9737	INCLAS	SIFIF

C. Urinanalyses

Number of Industrial Hygiene checks	22
Number of uranium determinations	39
Number of AAN/Creatinine for calibration	76
Total number of separate analysis performed in the laboratory	284
Number of uranium analysis showing greater than .0100 ppm	2

Edw. G. Struxness

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^{**}These samples invariably were taken in remote or otherwise inaccessible, or locally ventilated locations.

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^{*}Based on "less than" results as determined on 1/100 aliquots. Samples are being rerun "in toto" and it is anticipated that much lower values will be obtained.

TABLE 1. SAMPLE AIR-BORNE URAFIUM CCRCENTRATIONS

May 1 - 51, 1949

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1 23.5				Contract des des des des de la contraction de la	ڻ	Probable	Air-Borne Concen	200	Nes.
1 Secretaria 1	But 1 ding	e c	Type of Sample and Process Operation		Samples	Hi ghest	Lowest		
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The stating favor-looping ables onto press try			General Air	None Local Sxhaust		621	:	!	
19 Section All Section	9028	•	Breathing Level-Scooping ashes from pan into container	Good Good +	-	59.2	;	:	1
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## General Mr Ge			Breathing Level-Around filter press during illustica.		60	363	7.38	61.2	158.57
		;		General Exhaust		5	:	. 6	87.38
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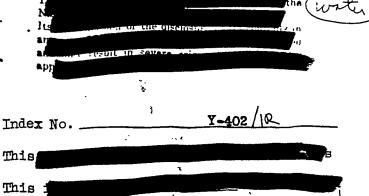
TAME II. INDUSTRIAL HYGISHB AIR SAMPLING RESULTS

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May 1 - 51, 1949

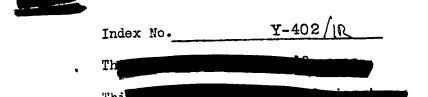
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Y-12 Plant

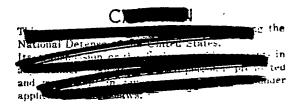
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HEALTH PHYSICS - HYGIENE PROGRESS REPORT

April 1 - 30, 1949

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E. G. Struxness



Oak Ridge, Tennessee May 13, 1949

Index No. Y-402/R
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HEALTH PHYSICS - HYGIENE PROGRESS REPORT

April 1 - 30, 1949

Part I - Introduction

A. General

The investigation of the alpha count method for determining uranium in urine and feces is still in progress. It has been decided that our requirements in this regard can best be served by resorting to the electroplating method of concentrating micro quantities of uranium on a thin sheet of silver. While other methods have been equally successful, the fact that efforts should be made here to duplicate methods in use at the University of Rochester has led us to this decision.

The procedure for determining amino acid nitrogen/creatinine ratios has been set up and a number of determinations have been, and are being made to study normal values.

John F. Stephens, Industrial Hygienist, attended the Conference on Industrial Health at Detroit April 4 through 7.

Part II - Health Physics

A. Routine Surveys

l. Air Surveys

A total of 150 samples of air-borne uranium were taken in 18 different work locations during the period. Approximately 25% of these samples gave concentrations in excess of 150 µg/M³ while 17% indicated concentrations exceeding an activity of 1225 d/Min/M³. Table I shows the locations, process operation and range in measured concentrations of those samples taken during the period.

2. Water Surveys

(a) Potable Water

Sample No.	Building	Uranium Conc. parts per billion	minute per 100 ml.
102	9731	4.1	3.0
103	9 733- 2	.55	.4
104	9 733- 1	.42	.3
105	9 7 66	.35	.25

413.66 355 Sec. 1144

(b) Storm Sewer

	Uranium	ANALYSES* Alpha Count	Total Acid	/ ity-CaCO ₂
Sample No.	ppm	per 100 ml.	ppm**	pH
105	.011	4.0	91	7.3
106	.012	4.6	100	7.5
107	.028	2.2	98	7.6
108	•056	. , 1.0	105	7.7
109	•020	3.7	105	8.0
110	C-047 550	(40/y. 3.2	103	7.9
111	.022	000 4/4, 3.1	95	7.6
112	034	5	95	7.6

(c) Sanitary Sewer

0. 110 6	1 2, 2, 04	ANALYSES*	(b)	24/19
Sample No.	'Uranium ppm	Alpha Count per 100 ml.	Total Acid:	ity-CaCO ₃ pH
97	.013	14.2	130	6.8
98	.019	15.0	97	7.1
99	.007	1.0	19	6.4
100	.092	•8	69	6.8
101	(.049	2.8	66	6.9
102	.041	3.4	112	7.2
103	•043	4.4	120	7.2
104	.023	2.1	120	7.3

3. Site Surveys

(a) Bldg. 9206, Room 41

A new exhaust system has been installed around the furnaces. The furnaces are completely enclosed with fireproof cemesto board with cemesto doors. The exhaust fans are designed to pull air across the furnace doors with a velocity of approximately 1000 ft./min. when one door is opened. The tests show a marked decrease in air-borne concentration of uranium in the room. As soon as more data becomes available a report will be made about this room.

7, til to wit = 682#

4. Shipment Surveys

Two hundred and sixty-eight lots of shipments were checked for alpha, beta and/or gamma activity in accordance with Standard Practice Procedure #20-A for release of property for shipment from the Y-12 Area.

B. Special Studies

1. Electroplating of Minute Quantities of Enhanced Uranium

Every effort is being made to duplicate the results of the University of Rochester's method of electroplating very small quantities of uranium. A

^{*}Based on a confidence level of 95%.

^{**0.0} ppm = pH 7.0



plating cell similar to the University's cell has been made from a pyrex glass nine expansion joint. The 10 volt power supply is somewhat smaller than the Rochester supply. Ammonium oxalate (30 ml of 0.4 M) is used as the electrolyte and 5 mg of Fe(NO₃)₃ is added as a co-plating agent. The uranium is plated on .005" silver foil. Each element of the apparatus appears to work satisfactorily, but to date only 50% of the uranium added to the plating bath can be counted following electroplating. In addition the plate is covered by a loosely adherent black powder which is independent of the uranium added to the original plating bath. (Uranium is added in the form of a uranyl nitrate solution which counts 27 alpha counts/min. and contains approximately .028 µgm U/ml.) It is felt that the black powder absorbs a portion of the alpha activity present on the plate and steps have been taken to determine its composition.

2. Amino Acid Mitrogen - Creatinine Ratio as a Test for Kidney Damage

Establishment of another test for kidney damage is under way. It consists of the measurement of the ratio of amino acid nitrogen to creatinine in urine.

Amino acids are assiduously conserved by tubular resorption so that only about 20% of that in the glomerular filtrate is normally excreted. A small loss in resorptive power of the proximal tubules should lead to a marked increase in the excretion of amino acids.

Creatinine excretion is a good measure of glomerular filtration and its clearance is unchanged following uranium intoxication, so the ratio of amino acids to creatinine concentration in urine can be used as a measure of amino acid excretion.

The Folin Colorimetric method is used for determination of creatinine while the determination of the amino acid nitrogen is by the copper method. The methods are being calibrated at this time.

3. Air Sampling Methods

The existing Y-12 air samplers are all moderately high rate samplers (2-3 M³/Min. compared to a respiratory rate of approximately 1 M³/Hr. or .59 Ft. Min. in man). A need has been felt for an air sampler approximating the breathing rate of man. In view of this need four rotary pumps have been secured for building such samplers. The pumps deliver approximately .895 Ft. Min., however the air flow can be easily regulated from .895 Ft. Min. down. Tentative plans are being drawn for a sampler head and air flow meter. These same pumps will also be used with the Cascade Impactor.

C. Personnel Monitoring

1. Alpha Hand Counts

It is to be noted that these recorded counts (at least two per day at times when the hands are known to be grossly contaminated, i.e., just before lunch and at the end of the work shift) do not represent the degree of hand contamination at times when personnel leave the work area for lunch and/or when they leave the plant at the end of the work day. Operating procedures provide, with certainty for adequate decontamination before personnel are permitted to leave. Many hand counts are therefore not recorded.

Hand Count Totals, March 1 - 31, 1949	healt	Count	Totals.	March	1	_	31.	1949
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Dept.		Total Right Hand Counts	Total Left Hand Above-tolerance Counts	Total Right Hand Above-tolerance Counts
Al4N	84	84	5	, 6
A16N	36	36	0	0
A2ON	535	535	12	8
B12L	1531	1531	3 96	462
H12D	3	3	2	2
	441	441	41	43
H12E	8935	8935	4157	4236
M12P	1	1	80	89
M15P	· 1228	1228		
Totals	12,793	12,793	4,693	4,846

2. Personnel Meters

A total of 106 film badges worn by personnel in the Assay Laboratories, Radiography Shop, Spectrograph Laboratory and "Metal" Machine Shops were processed during the period. The total number of pen chamber readings recorded was 1,030. None of these gave indications of exposure in excess of 50 mr per day.

A total of 1,760 finger film pads were worn during the month by 97 persons in C-1 and D Wings of Bldg. 9212, Radiography Shop and Room 17, Bldg. 9206. Three hundred and eleven of these pads showed detectable exposure of less than 100 mrep during one work shift. Sixty-nine showed exposures in excess of 100 mrep during one work shift, the greatest exposure being 1275 mrep. One hundred and twenty-nine pads were light struck or otherwise damaged so that the film could not be read.

Thirty-three ring badges were worn by 10 persons. None of these gave indications of exposure in excess of 50 mr per day.

Four plastic rings were worn by one person. None of these gave indications of exposure in excess of 50 mr per day.

3. Finger Ridge Impression Plates

Ninty-eight finger ridge impressions were made during April and sent to the University of Rochester for interpretation.

Part III - Instrumentation and Calibration

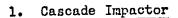
A. Instrumentation

The following instrument was obtained during April:

One (1) Cascade Impactor. (See Item B., 1. below.)

B. Calibration

Routine calibration of personnel monitors and survey meters is still being performed in a makeshift manner. Due to the inadequacy of the sources, instruments are not calibrated as frequently as is desirable: such instruments as Cutie Pie are not being calibrated.



A stainless steel impactor, which had been fabricated at K-25, was obtained from Uak Ridge National Laboratories and taken to Rochester for calibration. Mr. Sidney Laskin, who designed the modified Eritish Impactor, performed the calibration. Fig. 1 shows that the distribution plot for the stainless steel impactor exactly parallels that of the Rochester calibrated instrument.

The graph shows the results obtained against a large particle size atmosphere of uranium dioxide at a level of 15 mg/m³. Values plotted for the stainless steel impactor are the average of 3 test samples for each point. Since it was not possible to take simultaneous samples, the values for the Rochester calibrated impactor represent the average of 6 samples taken immediately before and after each test sample. The distribution plots were normal and taken as the best lines between points for stages B, C, D and E. The points for stage A are never used in determining this plot since its calibration constant varies with the upper size limit of the atmosphere tested. The calculated standard deviations are identical. The size mass median for the stainless steel impactor was 3.5 micra, being 8.6% lower than the value of 3.8 micra for the Rochester calibrated instrument.

Part IV - Industrial Hygiene

A. General

1. Instruments

The instrument shop was assisted in trouble shooting on our M.S.A. Benzol Indicator. Recalibration efforts have not yet been successful due to some lack of sensitivity, the cause of which is yet to be determined.

B. Surveys

1. Site Surveys

A total of 45 samples were taken of air-borne contaminants. Table II shows the locations, process operation, protective measures and range of measured concentrations obtained in these samples.

Out of 45 samples 9 were found to be above tolerance. The following is a breakdown of the above tolerance samples:

Contaminant	Building	No. of Samples Above M.A.C.
Ammonia	9212	1
Diethyl Ether	9212	2
Nitrogen Dioxide	9206	6

2. Special Surveys

Using an M.S.A. Combustible Gas Indicator a check was made to determine whether the use of plastic chips in the chrom plating tank gave rise to hazardous pockets of hydrogen gas. This possibility was judged to be negative.

C. Urinanalyses

- 1. A total of seven spot analyses of plant employees for uranium were completed. The highest value obtained was .010 ppm which is considered below tolerance.
- 2. A total of seven spot analyses of plant employees for urine catalase were completed. Only two of the determinations were greater than 20 cu mm 02.

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TABLE I. SAMPLE AIR-BORNE URANIUM CONCENTRATIONS

April 1 - 30, 1949

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Morking Level-Around furnace during reaction. Morking Level-Around furnace during reaction. Breathing Level-Unloading reactor. Morking Level-Unloading reactor. Morking Level-Unloading reactor. Morking Level-Unloading reactor. Morking Level-In front of muffle furnace while muffling. Local Exhaust General Level-Scooping oxide from pen into drum. General Exhaust General Stream General Str	Good General Exhaust 1 8.49 Good General Exhaust 5 1,894 664 664 600 General Exhaust 5 1,894 664 664 600 General Exhaust 1 32.55 1 1,00cal Exhaust 5 1 106,130 1 1,00cal Exhaust 6 1 1 1,725 60.2 60.	Good General Exhaust 1 8.49 1.86 281 386 Good General Exhaust 2 1.128 281 1.128 281 1.128 281 1.128 281 1.128 281 1.128 281 1.128 28.5 1.128 28.5 1.128 28.5 28.5 1.128 28.5 28.5 28.5 28.5 28.5 28.5 28.5 28			MODELL COVER THE CONTRACT OF C	Gerrer Pal	-	6.88	;	:	:
Breathing Level-Unloading reactor. Breathing Level-Unloading reactor. Working Level-Unloading reactor. Breathing Level-Unloading reactor. Breathing Level-Unloading reactor. Breathing Level-Exhaust General Livel-Scooping oxide from pan into drum. General Exhaust General Air. General Exhaust General Exhaust General Exhaust General Air. General Exhaust General Exhaust General Exhaust General Air. General Exhaust General Exhaust General Exhaust Breathing Level-Wecuuming out crucibles. Local Exhaust General Exhaust General Exhaust General Exhaust General Exhaust General Chaust General Exhaust General Exhaust General Exhaust General Chaust General Exhaust General Chaust General Exhaust General Exhaus	Good General Exhaust 5 720 168 664 660 660 660 671 Exhaust 1 52,6 1.001 Exhaust 1 52,5 1.002 Exhaust 1 52,5 1.002 Exhaust 5 1 106,130 1.002 Exhaust 1 1 106,130 1.002 Exhaust 6 6,40 9,72 60.02 E.coal Exhaust 6 6,40 9,72 60.02 E.coal Exhaust 5 2,555 60.02 E.coal Exhaust 2 1,455 247.9	Good General Exhaust 5 720 168 281 586 600 General Exhaust 5 1,894 664 829 1,128 1,128 6000 General Exhaust 1 52.6			Michig Level-Around furnace during resolution.	Gerre real		8.49	:	;`	:
Morking Level-Unloading reactor. Morking Level-Unloading reactor. Breathing Level-In front of muffle furnace while muffling. Local Exhaust General Air. Breathing Level-Exhaust General Air. Morking Level-Weckuming out crucibles. Morking Level-Vacuuming out cans.	Good General Exhaust 5 1,894 664 Good General Exhaust 1 52.6 General Exhaust 1 106,130 General Exhaust 1 106,130 General Exhaust 1 1,632 66.2 Local Exhaust 4 1,632 66.2 Local Exhaust 5 2,565 86.9 General Exhaust 2 1,466 General Exhaust 2 2,565 86.9 General Exhaust 2 1,725 247.9	Good General Exhaust 5 1,894 664 829 1,128 72,600 General Exhaust 1 52.6			BOTELER LOVEL TO THE TWINE CONTING TO THE TOTAL TO THE TANK THE TOTAL TO THE TOTAL	Ganara	ю	720	168	281	386
Breathing Level-In front of muffle furnace while muffling. Local Exhaust Norking Level-Scooping oxide from pen into drum. Seneral Air. Breathing Level-Scooping oxide from pen into drum. General Exhaust Working Level-Vacuuming out crucibles. Norking Level-Vacuuming out crucibles. Scooping out crucibles. Local Exhaust General Exhaust General Exhaust General Exhaust General Exhaust General Exhaust Breathing Level-Vacuuming out crucibles. Local Exhaust General Exhaust Scooping out crucibles. Exhaust Breathing Level-Vacuuming out cans.	G. Local Exhaust 1 52.6 General Exhaust 3 56.16 14.11 General Exhaust 1 106,130 General Exhaust 1 72,700 General Exhaust 6,460 9.72 Local Exhaust 4 1,632 60.2 Local Exhaust 3 2,555 86.9 General Exhaust 1 1,465 General Exhaust 2 1,725 247.9	G. Local Exhaust 1 52.6			breathing Lovel - Unioning Teacture		10	1,894	664	828	1,128
Morking Level-Th front of muffle furnace while muffling. Local Exhaust General Air. Breathing Level-Scooping oxide from pan into drum. General Shearst Morking Level-Scooping oxide from pan into drum. General Exhaust General Shearst General Shearst General Exhaust General Shearst Breathing Level-Vacuuming out crucibles. Morking Level-Vacuuming out crucibles. General Exhaust General Exh	Cost Exhaust 1 62.9	1 62.9 1.62 21.62 21.62 22.65 247.9 2.65 2			MOTETING LOVEL-DILLORGING JOHN CO.		7	32.5	;	:	:
Morting Level-Scooping oxide from pen into drum. General Exhaust General Exhaust Breathing Level-Scooping oxide from pen into drum. General Stream General Air. General Stream General Exhaust General Stream General Stream General Air. General Exhaust General Stream General Coral Exhaust General Coral Exhaust General Coral Exhaust General Coral Exhaust General Ex	General Exhaust	General Exhaust 5 35.16 14.11 16.2 21.82 General Exhaust 1 72.700			Districting Lavel - In 1701c of Mailie 141 Laco will a mailie in 1851 and 1	100	-	629	;	:	;
Description of the state of the	General Exhaust 1 106,130 General Exhaust 1 72,700 9,72 General Exhaust 4 1,632 60.2 Local Exhaust 3 2,555 86.9 General Exhaust 1 1,465 e to General Exhaust 2 1,725 247.9	Scooping oxide from pen into drum. General Exhaust 1 106,130 1 72,700 72,700 72,		Ş	MOTETING LOVEL-IN ITOM OF MALLIE INCHASE WHILE MALLIES		100	35,15	14.11	16.2	21 .62
Morking Lavel-Scooping oxide from pen into drum. Working Lavel-Scooping oxide from pen into drum. General Exhaust General Exhaust Breathing Lavel-Vacuuming out crucibles. Morking Lavel-Vacuuming out crucibles. Breathing Lavel-Vacuuming out crucibles. General Exhaust General Exhaust	General Exhaust 1 72,700	T2,700		2	COMMENSATION OF THE AMERICAN PROPERTY AND ASSESSMENT OF THE AMERICAN ASSESSMENT OF THE ASSESS		_	106,130	:	1	1
General Air. General Air. Breathing Level-Vacuuming out crucibles. Breathing Level-Vacuuming out crucibles. General Exhaust Constitute Level-Vacuuming out crucibles. Breathing Level-Vacuuming out crucibles. General Exhaust Constitute Level-Vacuuming out cans.	General Exhaust 8 6,460 9,72 Local Exhaust 4 1,632 66,2 Local Exhaust 3 2,555 86,9 General Exhaust 1 1,466 and to General Exhaust 2 1,725 247,9	General Exhaust 6 6,460 9.72 61.3 1,14785 60.2 60.2 875 628.5 Local Exhaust 3 2,655 86.9 161.9 934.2 60.0 161.9 934.2 60.0 161.9 934.2 60.0 161.9 934.2 60.0 161.9 934.2 60.0 161.9 934.2 60.0 161.9 934.2 60.0 161.9 934.2 60.0 161.9 934.2 60.0 161.9 934.2 60.0 161.9 934.2 60.0 161.9 934.2 60.0 161.9 934.2 60.0 161.9 934.2 60.0 161.9 934.2 60.0 161.9 934.2 60.0 161.9 934.2 60.0 161.0 161.9 934.2 60.0 161.0 1			Breathing Level-Scooping exide from pen inco union	1 7		72,700	:	:	1
Speathing Level-Vacuuming out crucibles. Breathing Level-Vacuuming out crucibles. Breathing Level-Vacuuming out cans.	Local Exhaust 4 1,632 60.2 Local Exhaust 3 2,555 86.9 General Exhaust 1 1,465 rom furnace to General Exhaust 2 1,725 247.9	Local Exhaust 4 1,632 60.2 376 928.6 E8.6 Local Exhaust 3 2,555 85.9 161.9 934.2 E. Exhaust 1 1,465 986.4 Local Exhaust 2 1,725 247.9 986.4		5	MOTERING LINEAL -COCCUPING CALLE ATTOM PRINT ATTOC AT MINI		œ	6,460	9.72	61.3	1,147.85
Local Exhaust 3	Local Exhaust 3 2,555 85.9 General Exhaust 1,465 rom furnace to General Exhaust 2 1,725 247.9	Local Exhaust 3 2,555 85,9 161,9 554,2 General Exhaust 1 1,725 247,9 986,4		;	Constant Airs Encething formal Wanning out orneibles.	×	*	1,632	8	376	828.6
General Exhaust	General Exhaust 2 1,465 General Exhaust 2 2,725 247.9	General Exhaust 2 1,726 247.9 986.4			Working Laws - Vacuuming out crucibles.	Local Exhaust	m	2,555	o. 200	161.9	2.408
6	General Exhaust 2 1,725 247.9	General Exhaust 2 1,725 247.9 sourt			Breathing Level -Vacuuming out cans.	General Exhaust		1,465	; ;	:	1 8
Constant Extracts					Breathing Level-Transferring crucibles from furnace to		~2	1,725	247.9	:	**00k
metal cons.					metal cans.						

(Continued on next page.)

TABLE I. SAMPLE AIR-BORNE URANIUM CONCENTRATIONS

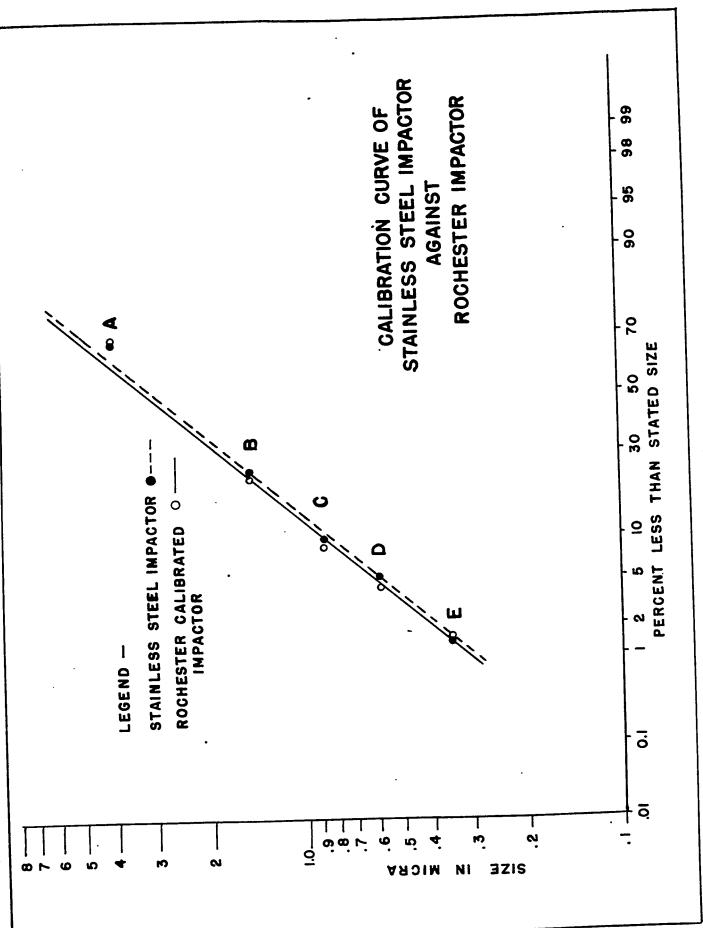
April 1 - 30, 1949

}	Room			Number	Probable	Air-Borne Cone	Probable Air-Borne Concentrations in Afain As	in Ar3
Salpitr	or Area	Type of Sample and Process Operation	Protective Messures	of	Highest	Lowest	Median	Meen
9		(Continued from preceding page.)						
9576	106	General Airs	None	-	6.44	ł	;	:
616	4	presenting Level-Around filter press during filtration.		-	15,85	:	:	:
3136	7	Condital Aire	General	82	96	48.8	;	27.9
		presenting Level-Loading reactor in dry box.	General		725	:	:	
		prestring Level-Removing reactor from under dry box.			184.8	;	:	:
		Breathing Level-Fnocking out reactor in dry box.	General		488	:	:	:
	4	morking Level-Enocking out reactor in dry box.	General		927.5	;	:	ŀ
	40+0	ceneral Air.		~	618	339	:	478
		presenting Level-Unionding hot press.			308	:	i	: 1
		moraing Level-unloading not press.	Exhaus	_	207.2	:	;	1
		breathing Level -Loading centrifugal caster.	-	es.	2,201	478	!	1.559
		breathing Level-Unloading centrifugal caster.	_	~3	11,900	1.695	:	6.797
	•	breathing Lavel-Removing casting from mold.	General	~	6,010	412	:	3,211
	7-04	Garara Alra	General	~	3,240	34.1	:	1.637
		Breathing Level-Muchining casting.	General		26,300	:	:	:
	n-29	Ceneral Airs	Good General Exhaust	~	363	160.4	:	256.7
		breathing Level - Removing screws from 11d of resotor.	Gneral	-	237.8	:	;	:
		breathing Level-Unloading rod mill reactor.	General	~2	1,810	461	•	1,135
	7		v	~	67.8	4.0	6.1	00° 50°
	ruraece	Forting Level-Unicading furnace.			153.6	:	:	:
	KOOM	Breathing Level -Removing lid and fire brick from furnace.		m	2,525	78.9	237	946.9
		brestning Level-Removing orugibles from furnace.		to.	341.6	114.1	263	239.6
		proming before the policy metal peating from furnace.		÷	186	78.9	157.6	140.5
		presenting Level -ulpping casting into drum of water.		~	474	33.8	:	255.6
		breathing Level-dawing castings with power sew.		~	70.1	59.3	:	64.7
	5	morking tevel+caming castings with power saw.		•	103.6	3.99	67.4	78.4
	1	General Alr.	General	7	51.7	;	:	:
	en tuo au	breathing Level-Machining metal casting.	Good General Exhaust	~	242	2.69		a 63.
	Shop	Working Level-Polishing metal casting.	Good General Exhaust		2,150	:	: 1	8 1
	a i	Breathing Level-Breaking buttons with hydreulic press.	Good General Exhaust		5,850	i	:	: !
	Storage	Working Level-Breaking buttons with hydraulic press.	Good General Exhaust	-	450	į		}
	Room			•	35.	:	•	:
9204-2	Chemical		None	~	7.03	c	:	
	Process	Morking Level-Burning conteminated carbons.	None	s.	21,15	. 0	:	10.57
						ř.		

TABLE II. INDUSTRIAL EYGITNE AIR SAMPLING RESULTS

April 1 - 30, 1949

Secretaring consecuency and account to the content of the conten	Contaminant and	Building	E COM	Type of Samile and Process Charatton	No.	Probable #	Probable Air-Borne Concentrations	entrations		
22 Desthing cose-dyen draw storage, Good General Enhant I 62 64.6 General and Local 4 73 66 64.6 General and Local 5 destrict Enhant 2 3	Eximum Allowable Conc.	•				Highest	Lowest	Kedien	Keen	Renerks
## Second 22 Streetings converged due for street, Good General and Local 1 15 15 15	o ja Outana	, 000	i			P				
##### ################################		3500	12	Breathing some-Open drum storage.	General	52	:	!	1	No personnel.
State Control State St	mdd oor - • • • • • •		22	Breathing zone and general air-Freeipitation,	General	73	92	. :	64.5	Coare-time eres
23.5 General Sit-Operators General Schout 1.50 1				filtering and cleaning press.	aust		3			esers drive serio
Sell			23	General air-Open drum storage.	General Exhaust	02	;	;	;	Wo nerecomes
106 General air-During precipitation. Schoute conditional 1 60 11846 11 644 General air and breathing cons-During filtration. Residence Schoute 2 188 99 11846 11 1846			34	Breathing zone-At filter press.	Good General and Local	* * * * * * * * * * * * * * * * * * *	:	1	: :	Men Arctellaton
9212 46-4 General air and breathing tone-During filtration Real-land Local Shower 4 (6-8) General air and breathing filtration Real-land Ceneral Schemet 2 1386 99 116.6 In 16-8 General air and breathing filtration. Steal-land Ceneral Schemet 1 99 116.6 In 16-8 General air and breathing filtration. Steal-land Ceneral Schemet 1 99 In 16-8 In 16-8 General air-During precipitation. Steal-land Ceneral Schemet 1 98 In 16-8 General air-During precipitation. Steal-land Ceneral Schemet 1 9738 Foundry Breathing cone-During conditions set in Ceneral Schemet 1 1,460 In 16-8 General air-During attraction. Steal-land Ceneral Schemet 1 1,460 In 16-8 General air and breathing cone-During stear gurding. Steal-land Ceneral Schemet 2 1,460 In 16-8 General air and breathing cone-During stear gurding. Steal-land Ceneral Schemet 2 1,460 In 16-8 General air and breathing cone-During stear gurding. Steal-land General air and breathing sone-At landlary of Geod General and Rocal Ceneral and Scealland General air and breathing sone-At landlary of Geod General and Poor Local Affect 2 10-8 General air and breathing sone-At landlary of Geod General and Poor Local 4 10-8 General and Poor Local General and Poor Local General and Poor Local General and Poor Ceneral Schemet 2 10-8 General Air and breathing sone-At landlary Real-Landlary and Fair 3 92 Ceneral Air and breathing sone-At landlary Real-Landlary and Fair 3 General Air and breathing sone-At landlary Real-Landlary and Fair 3 Ceneral Air and breathing sone-At landlary and Fair 3 Ceneral Air and breathing sone-At landlary General and Poor Local General and Poor Ceneral Air and Breathing sone-At landlary Real-Landlary and Fair 3 Ceneral Air and Breathing sone-At landlary Real-Landlary and Fair 3 Ceneral Air and Breathing sone-At landlary Real-Landlary and Fair 3 Ceneral Air and Breathing sone-At landlary and Fair 3 Ceneral Air and Breathing sone-At landlary and Fair 3 Ceneral Air and Breathing sone-At landlary Air and Breathing Sone-At landlary Air and Breathing So			,		Exhaust	?				New Tite Call actions
46-8 General air and breathing zone-During filtration Realist Stands Stands 46-8 General air and breathing cone-During filtration Realist Stands 46-8 General air-During precipitation. Steelland General Stands 47-4 General air-During state pouring. Steelland General Stands 41-6 6-7 6-7 7-7 7-7 7-7 7-7 7-7 7-7 7-7 7			106	General air-During precipitation.	Good General and Local	8	:	:	;	at foot of platform
46-b General sixt and brackling some-During filtration. Standard Shauet 2 1886 99 1184.6 In the Common of Common			;		Exhaust					
46-B General air-During precipitation. Steallent Schaute 1 99 11 47-A General air-During precipitation. Steallent Ceneral Schaute 1 99 11 47-B General air-During extraction. Steallent Ceneral Schaute 1 84 11 9736 Foundry Breathing streetion. Steal of Foundry Schaute 1 84 11 9727 47-B General air-During extraction. Steal of Foundry Schaute 1 1,460 11 9728 Foundry Breathing stone-During exter puring. Steal of General Schaute 1 1,460 11 9728 Foundry Breathing stone-During exter puring. Steal of General Schaute 1 1,460 11 9729 6 25 Breathing stone-During there with fair Cenel Schaute 1 1,460 11 9720 747 No. 25 Breathing tone-During there with fair General Schaute 2 111 2.9 7 110 9720 747 No. 25 Breathing tone-During there and dryling of Pair General and Excellent 5 1,200 449 600 747 No. 26 Breathing tone-During the General and Schaute 2 110 2.9 7 110 9720 747 No. 27 Inches of Ceneral and Breathing tone-At leaching in drum. Fair General and Schaute 2 50 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5		32126	4-94	General air and breathing zone-During filtration.	Excellent General	138	66	!	118.5	Interestttent
47-6 General air-During precipitation. State of the centeral State of the content State of the content State of the centeral Exhaust 1 84 1 11 11 11 11 11 11 11 11 11 11						-				operation.
47-4 General sir-During practitation, are Pair Icon Shhuat 1 47-8 General sir-During extraction, Secal and Pair Icon Shhuat 1 47-8 General sir-During extraction, and Pair Icon Shhuat 1 9212 47-8 Foundry Breathing sone-During extraction and Pair Icon Shhuat 1 9212 47-8 Foundry Breathing sone-During extraction, with fair Icon Shhaat 1 9214 97-8 Foundry Breathing sone-During extraction, with fair Icon Shhaat 1 9215 47-8 Foundry Breathing sone-During extraction, with fair Icon Shhaat 1 922 6 Shreathing sone-During extraction, with fair Icon Shhaat 9 92-96 25 Shreathing sone-During part of Tractors 1 92-96 25 Shreathing sone-During part of Tractors 1 92-96 25 Shreathing sone-During part of Tractors 1 92-96 26 Shreathing sone-During sone-Atlanching in drum. Fair General and Paor Local 1 92-96 92-			46-B	General air-During precipitation.		86	ł	;	:	Interest thent
47-8 General air-During particition. Scallant General Exhaust 1 64 11 9738 Foundry Bresthing straction. For does not be structed to the structure and Fair Local Exhaust 1 64 11 922 47-8 Kort level-During extraction. For does not be structure 1 1,460 11 922 47-8 Kort level-During sther puring. Scallant General Stheast 2 660 3 0 72 In with Fair Local Exhaust 3 1,460 In with Fair Local Exhaust 3 1,460 1 In press. 922 47-8 Kort level-During sther puring. Scallant General Stheast 2 660 3 0 72 In with Fair Local Exhaust 3 1,260 440 690 747 Na Local Stheast 3 1,260 10 10 10 10 10 10 10 10 10 10 10 10 10					and Fair Local Exhaust					operation
Foundry Breathing sone-During extraction. Facel Schemat 9222 47-8 Foundry Breathing sone-During cadmium metallising. For done in bood-Afrline 1: 9222 47-8 Foundry Breathing sone-During cadmium metallising. For done in bood-Afrline 1: 9222 47-8 Foundry Breathing sone-During cadmium metallising. Scallent General Schemat 9224 47-8 Fort level-During sther pouring. Scallent General Schemat 9225 African air and breathing ione-During sther viet Fig. Local Schemat 9226 25 Breathing sone-During level and drying of Local Schemat 9226 25 Breathing sone-During level and drying of Local Schemat 9226 34 Fort level-At leaching and drying of Pari General and Excellent 3 1,205 440 600 747 Ne 1004 General air and breathing sone-At leaching in drum. Fair General and Poor local 4 9222 49-C General air and breathing sone-At leaching and drum. Enhance 9224 6004 General air and breathing sone-During weaking (Good General and Poor local 4 9225 10 General air and breathing sone-During weaking (Good General and Poor local 4 9226 600 2.9 23.7 114 9227 600 600 2.9 23.7 114 9228 600 600 600 600 feneral and for and breathing sone-During weaking (Good General and Poor local 4 9229 600 600 600 feneral air and breathing sone-During weaking (Good General and Tair 3 92 32 66 63 Fe 1009 17 600 600 600 feneral and Tair 3 92 66 63 Fe 1009 17 600 600 600 feneral and Tair 3 92 66 63 Fe 1009 17 600 600 600 feneral and Tair 3 92 66 63 Fe 1009 17 600 600 600 feneral and Tair 3 92 66 63 Fe 1009 17 600 600 600 feneral and Tair 3 92 66 63 Fe 1009 17 600 600 600 feneral and Tair 3 92 66 65 Fe 1009 17 600 600 600 feneral and Tair 3 92 66 65 Fe 1009 17 600 600 600 feneral and Tair 3 92 66 65 Fe 1009 17 600 600 600 feneral and Tair 3 92 66 65 Fe 1009 1009 1009 600 600 feneral and Tair 3 92 60 65 Fe 1009 1009 1009 1009 1009 1009 1009 100			٧-/4	veneral air-During precipitation.	Excellent General Exhaust 1	84	:	;	ŀ	Intermittent
Poundry Breathing zone-During extraction. 9212 47-8 Foundry Breathing zone-During extraction. 9212 47-8 Foundry Breathing zone-During extraction. 9222 47-8 Fort level-During step pourling. 9226 25 Breathing zone-During step pourling. 9226 25 Breathing zone-During step pourling step received a step in the step in			47.B	Commence of the Property of the Commence of th	and Fair Local Exhaust					cperation
Foundry Breathing cone-During cadmium metallizing. Fort does in hood-Airline 1. 0 In respirator worm. 9212 47-B Kort level-During sther pruring. 9212 47-B Kort level-During sther pruring. 9220 25 Breathing cone-During sther vith Fair Local Stheast 1 1,460 In with Fair Local Stheast 9600 3 0 72 in vith Fair Local Stheast 9600 3 0 72 in press. 9220 25 Breathing cone-During leaching and drying of Local Stheast 9600 6900 11 2.9 7 in Local Stheast 9700 6000 6900 11 1,200 440 600 747 Ne Local Stheast 9700 6000 6900 11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			3	concret air-coring extraction.	Excellent General Exhaust 1	84	:	;	:	Intermittent
Foundry Breathing some-During each numerallizing. Fort done in hood-Airline 1** 0 in respirator worn. 9212 47-B Kort level-During etter puring. 9222 47-B Kort level-During etter puring. 9226 25 Breathing zone-During lack of the feature	admium				and "air Local Exhaust					operation.
Figure 47-8 Hort level-During ether pruring. 9206 26 Sheething the breathing sther pruring. 9206 26 Sheething some-During ether "collent General Schaust 9 660 3 0 72 In with Pair Local Exhaust 9 660 3 0 72 In press. 9206 26 Sheething some-During leaching and drying of Pair General and Excellent 2 III 2.9 7 In press. 9206 26 Sheething some-During leaching and drying of Cool General and Excellent 2 III 2.9 7 In Local Schaust 6 Good General and Excellent 5 I,2CC 440 600 747 No Local Schaust 6 Good General and Excellent 6 Good General and Excellent 6 Good General and Excellent 6 Good General and Fall Good General and Foor Local Schaust 7 In Schaust 7 In Schaust 108 Tork level-Leaching in drum. Fair General and Poor Local I Schaust 6 Good General and Fall Good General and Foor Local Schaust 7 In Good General and Fall Good General and Foor Local Schaust 6 Good General and Fall Good General And Good General And Good General Good Ge	-A-C 0.1 Mg/M3	9738	Foundry	Breathing zone-During cadmium metallizing.		c				
### Solution of the control of	;					>	ŀ	:	1	This work is only of
Second State Second State Second State 1,460										an occasional nature,
General air end breathing zone-During ether "vith Fair Local Sxhauet 9 650 0 7 72 Statistion. Statistic cone-During leaching and drying of Local Sxhauet 9 650 0 7 747 Local Stream of Local Sxhauet 9 650 0 7 747 Local Sxhauet 9 11 2.9 7 Local Sxhauet 9 650 0 7 747 Local Sxhauet 9 11 2.9 7 Local Sxhauet 9 11 2.9 7 Local Sxhauet 9 190 0.5 0.5 Local Sxhauet 9 190 0.5 0.5 Local Sxhauet 9 190 0.5 0.5 Shauet 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		9212	47-B	Work level-During other pouring.		1 450				1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
General air rnd breathing zone-During ether "xeellent General Shaust should be struction. 9206 25 Struction. 9206 25 Struction. 9206 26 Struction should be structured and drying of Pair General and Sxeellent 2 11 2.9 7 1008 1						025.1	ŀ	ŧ	:	Intermittent
9206 25 Breathing zone-During leaching and drying of Feir Gereral and Excellent ? 11 2.9 7 Local Tarburst Statement of Local Tarburst Local Tarburst Local Tarburst				General air and breathing zone-During ether	Zxhanat	SKO	•		É	operation.
9206 26 Breathing zone-During leaching and drying of Feir General and Excellent ? 11 2.9 7 press. 34 Fork level-At leaching of reactors. Constal rate level and breathing sone-At leaching of Good General and Excellent 6 Constal rate level-Leaching in drum. Contract level-Leaching in drum. Fair General and Poor Local 1 193 23.7 Exhaust Constal rate breathing zone-At leaching in drum. Exhaust Constal rate level-Leaching zone-At leaching (Good General and Poor Local 4 55 2.9 23.7 Exhaust Constal rate level-Leaching zone-At leaching (Good General and Exhaust Constal rate level-Leaching zone-At leaching (Good General and Exhaust Constal rate level-Leaching zone-At leaching (Good General and Exhaust Constal rate level-Leaching zone-During weaking (Good General and Tair 3 92 32 66 63 12 12 12 12 12 12 12 12 12 12 12 12 12	:	,		extraction.	Fxhaust	}	י	>	2)	Intermittent
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Decel Tarksust General air and breathing forestors. General air and breathing zone-At leaching in drum. Fair General and Poor Local 1 190 2.9 2.2 Statestors. General air and breathing zone-At leaching in drum. Fair General air and breathing zone-At leaching in drum. Exhaust Good General and Poor Local 1 190	udd gz -	9206	22	Breathing zone-During leaching and drying of	Srcellent	=	¢			
General air and breathing zone-At leaching in drum. Condition of Good General and Excellent 6				press		:	b	•		Intermittent
Constal air and breathing zone-At less thing of Good General and Excellent 6 0.5 0.5 0.5 0.5 108 Work level-Lesching in drum. 108 Work level-Lesching in drum. Fair General and Poor Local 1900 1900			34		Excellent	ا مرتی	077	Ş		Operation.
General air and breathing zone-At let ching of Good General and Excellent 6 0.6 0.5 0.5 0.5 cestors. 108						•	ř	3	č	New installation
Conternal air and breathing zone-At let ching of Good General and Excellent 6 0.6 0.5 0.5 0.5 0.5 restors. 108										intermittent one office
Local Exhauet 108 Work level-Leaching in drum. Fair General and Poor Local 1 190 23.7 Fixhaust Good General air and breathing zone-At leaching in Good General and Facellent 2 4.5 0 2.2 Local Exhaust 1,006 17 General air and breathing zone-During weshing Good General and Tair 3 92 32 86 63				nę of		9.0	0.5	0.5	6	West treetellas
Mork level-Leaching in drum. Fixheust General mir and breathing zone-Leaching in drum. Fair General end Poor Local 4 50 2.9 23.7 Exhaust Good General end 2 4.5 3 2.2 Local Exhaust Good General end Tair and breathing zone-During weshing Good General end Tair 3 92 32 86 63				remercore.	Local Exhauet) }	;	intermittent
General air and breathing zone-Leaching in drum, Feir General and Poor Local 4 50 2.9 23.7 9212 49-C General air and breathing zone-At leaching Good General and Tacellent 2 4.5 0 2.2 Local Exhaust Local Exhaust 1,006 17 General air and breathing zone-During weshing Good General and Tair 3 92 32 86 63			108							operation.
General air and breathing zons-Jeaching in drum, Feir Boor Local 4 50 2.9 23.7 Exhaust Good General and breathing zoneAt leaching Good General and Twoellent 2 4.5 0 2.2 Josel Exhaust Good General air and breathing zone-During weshing Good General and Tair 3 92 32 66 63					Fair General and Poor Local 1	190	:	:	:	Short term operation.
9212 49-C General air and breathing zoneAt leaching Good General and Excellent 2 4.5 0 23.7 9212 49-C General air and breathing zoneAt leaching Good General air 3 92 32 66 63 9212 49-C General air and breathing zone-During weshing Good General and Tair 3 92 32 66 63				40 0		Š	•			
9212 49-C General wir and breathing zoneAt leaching Good General and Excellent 2 4.5 3 2.2 Coef Exhaust Of reactors. 9212 49-C General wir and breathing zone-During weaking Good General and Tair 3 92 32 66 63 Coef Operation.						3	7°	:	23.7	Instead use of
of reactors. Joeal 2xhaust 9206 17 General air and breathing zone-During washing Good General and Tair 3 92 32 66 63		9212	49-c		Secollent	•	¢		,	respirators noted.
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			<u>:</u>	shing	'air	36	32	93	8	Pespiratore norm part
	() () () () () () () () () ()									of the time.



FIGURE

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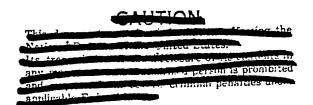
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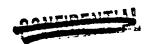
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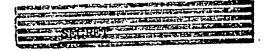
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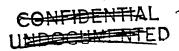
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Central Reports and Information Office

Date Issued: APR 25 1949







HEALTH PHYSICS - HYGIENE PROGRESS REPORT

March 1 - 31, 1949

Part I - Introduction

A. General

The investigation of the alpha count method for determining uranium in urine was continued. Different methods of separating the uranium from the organic matter of the urine have been tried and a large number of samples have been evaporated on plates and counted.

Together with Dr. A. G. Kammer, the present author visited the Atomic Energy Project at the University of Rochester from March 27 to March 31. The purpose of this visit was to consult with representatives of that site on matters pertaining to (1) measurement of air-borne particulates and (2) a long range study of the physiological effects which may or may not be produced by minimal exposures to the personnel in the "Sunflower" and "Daffodil" programs. Representatives present at these conferences included the following:

Atomic Energy Commission

Dr. J. H. Sterner

Carbide & Carbon Chemicals Corporation

Dr. A. G. Kammer

Mr. E. G. Struxness

University of Rochester

Dr. H. A. Blair

Dr. J. W. Howland

Dr. J. B. Hursh

Dr. H. C. Hodge

Dr. H. E. Stokinger

Dr. W. F. Neuman

Dr. A. Rothstein

Part II - Health Physics

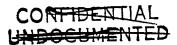
A. Routine Surveys

1. Air Surveys

A total of one hundred and forty-eight (148) samples of air-borne uranium were taken in twelve (12) different work locations during the period.

Approximately 28% of these samples gave concentrations in excess of







150 ug/ M^3 while 35% indicated concentrations exceeding an activity of 1225 d/Min/ M^3 . Table I shows the locations, process operation and range in measured concentrations of those samples taken during the period.

2. Water Surveys

Potable water, storm sewer (East Fork Poplar Creek) and sanitary sewer samples are taken regularly at predetermined frequencies and locations. The analytical results are tabulated below:

(a) Potable Water

Sample No.	Building	Uranium Conc. parts per billion	minute per 100 ml.
98 99	9206 9206		0.55 1.9 0.1
100 101	9204 - 3 9206	56	0.4

(b) Storm Sewer

	Uranium	Alpha Count Total Acidi	ty-CaCO3 pH
Sample No.	ppm	HOT 200 MAC	
97	0.034	3.6 100	7.4· 7.5·
98	0.008	1.4	-
99	0.012	1.35	7.4
100	0.011	2.35	7.6
101 .	0.020	0.5	7.6
102	0.014	.94 116	7.8
	0.008	1.4 77	7. 7
103 104	0.043	9 98	7.3

Based on a confidence level of 95%.
**0.0 ppm = pH 7.0

(c) Sanitary Sewer

		ANALYSES*	Total Acidity-CaCO2	
Sample No.	Uranium ppm	Alpha Count per 100 ml.	ppm**	pH
85	0.19 · !	12.3	107 · · · · · · · · · · · · · · · · · · ·	6.98 7.2
88 89	0.13 · 0.021	3.9 4.4	125	7.3
90 91	0.032 0.009	5.7 1.5	105 132	7.1 6.9
92	0.013	2.7	131 127	7.1 7.2
93 94	0.010	2.0	97 169	6.9 7.2
96	0.016	• 1	103	1.00

*Based on a confidence level of 95%.
**0.0 ppm = pH 7.0



SEC

3. Site Surveys

(a) Nidway Salvage Material

Approximately 42 barrels of metal salvage were moved from M-3 Warehouse to the AEC Contaminated Metal Storage Area, and 128 barrels of residue salvage were moved from the Yard to the X-10 Burial Ground. The contamination level of this material was of a very low order.

(b) Building 9212, Contaminated Fire Brick

Approximately 15 barrels of contaminated fire brick were moved to the X-10 Burial Ground.

4. Shipment Surveys

Three hundred (300) lots of shipments were checked for alpha, beta and/or gamma activity in accordance with Standard Practice Procedure #20-A for release of property for shipment from the Y-12 Area.

B. Special Studies

1. Urinary Uranium for Determining Degree of Exposure

The most efficient method of extracting and monitoring (by measuring alpha radiation) enhanced uranium from urine has not been determined although the following methods are under scrutiny at this time:

- (a) The passage of the digested specimen through an ion exchange column to remove anions which might interfere later; extraction of the uranium with di-ethyl ether and subsequent backwash with equal volume of water; and evaporation of water backwash and the transfer of the residue to a platinum plate for counting. This method has been found to work satisfactorily at other AEC installations but requires elaborate equipment and considerable time.
 - (b) The precipitation of the digested acidified specimen with NH₄OH using Fe(NO₃)₃ as a carrier followed by extraction with penta ether and evaporation on a plate for counting. This method has been used for uranium of fairly high concentration in water solutions, but it is not known if the NH₄OH will precipitate the uranium quantitatively from very dilute solutions.
 - Another previously proven method involves a precipitation of the uranium with NH₄OH in the presence of Al(NO₃)₃. The precipitate is dissolved and evaporated on several platinum plates. This method has the advantage of the elimination of the extraction and its many complications, but necessitates the counting of several plates for each sample.
- (d) The fourth method, relatively new and untried, is the only one which involves electroplating. The digested sample is extracted with a 2:1 mixture of di-ethyl ether and acetone solution and electroplated from this organic layer following the addition of a coplating agent, possibly Fe(NO₃)₃. At least one installation (University of

SPORET

Rochester) has used this method to good advantage and it will be tried here because of its reported speed and accuracy.

Work will continue until one of these methods has been adapted to our accuracy and precision requirements.

2. Air Sampling Methods

The three new Electro-Lux Air Somplers were delivered during March. The somplers, however, have not yet been put into use. No filter paper has been found which will pass sufficient quantities of air to give readings on the relatively insensitive liquid manameter.

3. Finger Pad Monitoring

The Densichron densitometer is now in use. It has been mounted on a desk and is foot operated leaving the hands of the operator free to move the film into position for reading and to make any other necessary adjustments. Some difficulty has been experienced in obtaining a steady light source; however, it has been found that the Densichron is somewhat more sensitive and convenient than the Densitometer which had been used previously. The Densichron densitometer has an a.c. energized electromagnet placed around the phototube to modulate its election currents. The resulting a.c. voltages are amplified some 50,000 times and fed into an a.c. voltmeter. The output of the a.c. amplifier is stable and results are reproducible. Figure I shows the Densichron densitometer and its mount.

C. Personnel Monitoring

1. Alpha Hand Counts1

Wand Count Totals, February 1 - 28, 1949

	Total Left Hand Counts	Total Right Hand Counts	Total Left Hand Above-tolerance Counts	Total Right Hand Above-tolerance Counts
Al4N Al6N Al7N A2ON Bl2L Hl2D Hl2E Ml2P Ml5P	73 37 6 395 1223 14 368 6274	73 37 6 395 1223 14 368 6274 1124	12 2 0 4 516 8 54 5151	11 2 0 4 564 8 64 3184 71
Totals	9,514	9,514	3,836	3,908

It is to be noted that these recorded counts (at least two per day at times when the hands are known to be grossly contaminated, i.e., just before lunch and at the end of the work shift) do not represent the degree of hand contamination at times when personnel leave the work area for lunch and/or when they leave the plant at the end of the work day. Operating procedures provide, with certainty for adequate decontamination before personnel are permitted to leave. Many hand counts are therefore not recorded.

2: Personnel Neters

- (a) A total of one hundred and three (103) film badges worn by personnel in the Assay Laboratories, Radiography Shop, Spectrograph Laboratory and "Metal" Machine Shops were processed during the period. The total number of pen chamber readings recorded was 1104. None of these gave indications of exposure in excess of 50 mr per day.
- (b) A total of one thousand nine hundred and forty-five (1945) finger film pads were worn during the month by 95 persons in C-1 and D' Wings of Bldg. 9212, Radiography Shop and Room 17, Bldg. 9206. Three hundred and sixty-nine (369) of these pads showed detectable exposure of less than 100 mrep during one work shift. One hundred and twelve (112) showed exposure of more than 100 mrep during one work shift, the greatest exposure being 740 mrep.

Forty (40) ring badges were worn by 10 persons. None of these gave indications of exposure in excess of 50 mr per day.

Seven (7) plastic rings were worn by two persons. None of these gave indications of exposure in excess of 50 mr per day.

Part III - Instrumentation and Calibration

A. Instrumentation

The following instruments were obtained during March:

Three (3) Electro-Lux Air Samplers. One (1) Densichron Densitometer.

B. . Calibration

A number of instruments, all of the survey meters, dust samplers, and the Berkeley Scaler were calibrated during the period. This routine calibration is being done in a rather hit and miss fashion. The gamma source is a 4.4 mg standard of radium, borrowed from another department. This has to be used for calibrating film and meters. The x-ray source for calibration belongs to Medical and is used when necessary.

Part IV - Industrial Hygiene

A. General

Arrangements were made to take samples during this month on ether and chromic acid mist. The M.S.A. Benzol indicator was calibrated and used for sampling ether (+ 5%). The Wilson Standard Impinger apparatus was used for chromic acid mist with a straightforward chemical procedure (+ not more than 5%).

A colorimetric method is being developed for cyanide tests and is to be used during the month of April at the Plating Shop.



A sample of Unichrome lacquer thinner, currently used in the Plating Shop, is being analyzed at the laboratory.

A one inch blanket of plastic chips reduced chromic acid mist concentrations tenfold at the Plating Shop.

B. Site Surveys

A total of seventy-four (74) samples were taken of air-borne contaminants. Table II shows the locations, process operation, protective measures and range of measured concentrations obtained in these samples.

Out of seventy-four (74) samples twenty-seven (27) were found to be above tolerance. The following is a breakdown of the above tolerance samples:

Contominant	Building	No. of Samples Above M.A.C.
Ammonia	9206 .9212	2
Carbon Monoxide Chromic Acid Ether	9712 9744 9212	12 5

C. Urinanalyses

- 1. A total of fifty (50) spot analyses of plant employees for uranium were completed. The highest value obtained was 20128 ppm which is considered below tolerance.
- 2. A total of fifty (50) spot analyses of plant employees for urine catalase were completed. This test, while a general indication of kidney damage, will also indicate the presence of epithelial cells, mucous pus, bacteria, or blood cells. Although there were a large number of positive indications, none of the employees could definitely be said to have kidney impairment.

Total number of catalase determinations 50 Number of determinations greater than 20 cu mm 02 23

3. One beryllium urinanalysis was made and found to be negative.

E. G. Struxness

jwo

At the University of Chicago a large number of office workers who had no contact with uranium whatsoever were checked for catalase and the results varied from 0-20 cu mm 02 liberated. Only those results over 20 cu mm 02 were considered positive.

TABLE I. SAMPLE AIR-BORNE URANTIM CONCENTRATIONS

March 1 - 31, 1949

				Number	Probabl•	Probable Air-Borne Comcentrations in d/Min/M	entrations i	m d/Min/Mo
Building	• 7	Type of Sample and Precess Operation	Protective Measures	ef Semples	Highest	Lowant	Radies	Moan
	Area			ca	12,560	c 19 's	9,760	8,643.3
9206	O.	Breathing level Dumping contaminated same into				•		3. 1.60
		hopper. Morking levelSame as above.	None	- c a	28,800	16,850	26,800	24,150
	17	General air"Chip" recovery.	Exhaust	•	,	· •		
		beathing level chine on to press trov.	Local Exhaust	~	1,768	163	:	: :
			Local Exhaust	.	546	1 46	, ;	:
		preaching levelresoured seels of contrifugal dryer.		•••	124		•	;
		C	Exhaus t	1	844	5] •8	271 /	297.1
	4	General airWetal recovery. Breathing levelVecuuming contaminated carbon	Gra VaskKocal Exhaust	11	30,200	327	9,435.5	10,400
		orubibles.	Gas WeskLocal Exhaust	ca .	20 , 4 00	?,555	E,340	9,431.7
	,		Good General Exhaust	C#	59.5		44.3	29:1 2 9:1
5. yel e	7100	Breathing level Knooking out reactor in dry box.	General	حف ہ	7,480	1,742	7,350	8.407.5 107.5
*		Working level Knooking out reactor in dry box.	Conorel	v 2	1.746	235	;	980
		Breathing level Removing reactor from under dry box-wood Breathing level Around seals of dry box while Good	Good General Exhaust	∞ :	3,400	76.9	280	657. 210
¥		loading resotor. Breathing levelSecuring cap on resotor.	Good General Exhaust		4,480	:	:	:
+	#-D 8	44-D Storage Room Recathing lawel Breaking buttons with hydrolic	Good General Exhaust	ca	1,369	732	1,349	1,160
		press.			46,200	3,370	8,248	19,272.6
	A	norking tevetbreaking bustons with systoria proses	Good General	9	4,780	2.82	64.7	1,092,1
	40	Breathing levelLoading contrifugal caster.	General	· 65	1,726	260	0.20	790.0
	*	Working levelLoading centrifugal caster.	General	۰ ۸۰	531	362 261		939
	· ·	Breathing level Losding crucible with broken metal.	Good General	- ~	334		1	;
٠,	•, ~	Working levelLoading orucible with broken metal.	6000	~ •	38.400	14,980	:	26,690
		Breathing level Unloading not press.		~> <i>r</i>	31 000	22,100	;	26,550
-	•	norking levelunionding not press.	Local Exhaust	∿ :	1,052	823	!	967.5
	•	broating lovel Londing measure desert.		_	295	:	;	:
		HOTELDE LOVOLCOROLDE BYRKELO CESTOT.	Local Cxhaust	۰ هـ	4,110	436	1,580.5	1,921.7
		Monthly level-like orders whethe constant		અ	2,820	1,976	2,210	2,335.3
		norming level Removing coating from crucible.	\sim	~	49,600	4,060	:	23,330
•	•	Working levelUnloading centrifugal caster.	General		386	•	: ;	; ;
		Breathing level Breaking carbon mold off metal	Good General Exhaust		\$. X	;	;	
		casting. Torking lasting in hot press.	Local Exhaust		208	31	1	614.7
		Breathing level Fressing brickettes.		v	1,201	26.4	;	0100
,		(Continued on next page.)			}			

TABLE I. SAMPLE AIR-BORNE URANIUM CONCENTRATIONS

Varch 1 - 31, 1949

				namos.	Probable /	Probable Air-Borne Concentrations of C/	Oliciarione	6 4/11/1
Building G	Area Area	Type of Sample and Process Operation	Protective Measures	of Samples	Highost	Lowest	Wedian	Keen
								;
	:	rom preceding page.)	Good General Exhaust	-	84.5	:	;	881.8
9212	46-D		Consession	~	818	306	;	601.00
		volMachining uranium metel.	Collegal	, م	118	;	:	;
		Breathing level Polishing cadinium on metal casting. Good	General		861	;	:	;
		working level-Polishing andinium on motal casting.	Good General Exhaust	, -	449	307	;	422.6
n	3		Good General Exhaust	• ~	2		:	;
1	A-20	Western the common will while in operation.		,	• •	43	:	37770
			Good General Exhaust	83	110	0		
		mill remator. Description levelUnlanding rod mill reactor in dry	Good General Exhaust	ю	3,790	1,890	:	2,0
		DOM:		•	6.970	: .	:	
		Working level Unloading rod mill reactor in dry box Good General		, ب	9.76	;		13
	46-0	General air.	Cood General Exhaust	ca ·	306	4	80	101
		Broathing towar authority of American and a second		•			:	
	•	CONTRACTOR SELVEROS	Good General Exhaust	نو .	5 100	. :	;	
	52 - C	Breathing levelHomowing screws from top of rod	Good General Exhaust	•	2,000	;	-	ر ا الله الله الله
		mill remotor. Breathing level Unloading rod mill remotor in dry	Good General Exhaust	۵,	4,060	1,755	;	2,08,2
		DOX.		Α.	44.5	0	12,26	17.2
	2	General air.		٠,	559	0	69.2	136.4
	Wachir	Nachine Breathing level Machiring metal coatings.	Ganare 1	⁵	1.160	94.1	541	598,3
<u> </u>	Shop	Breathing level Polishing metal castings.	Opportunity Commence					
	2	neathing lavel Removing fire brick from furnace.	Local Exhaust Good General	2	992 .	121	:	
			Exhaust	3	346	330	:	330
	Room	Breathing level Removing carbon crucible from	Local ExhaustCood General		•			•
		furnace.	Local ExhaustCood General	21 2	496	264	:	000
		BLOSCUTTE TOACT MARCA P	Exhaust		D 75 P	o	;	429
7		Breathing level Dipping casting into drum of water.	. Local ExhaustGood General	6	80	•		1
\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \								M

TABLE II

INDUSTRIAL HYGIENE AIR SAMPLING RESULTS

Warch 1 - 31, 1949

	<u>ڙ</u>									×		Kexie	
Perchlorethylene N.A.C 200 ppm	W.A.C 400 ppm	#ther	M.A.C 0.1 Wg/M3	bromio Acid (CrO2)		Carbon Monoxide		·		M.A.C 100 ppm		Conteminant and Allowable Conc.	
9206		9212		9744	9738	9712		9212		0	9908	Building	
17		47-B	Shop	Pleting	Foundry	Garege	46-B 47-A 47-B	102 46-1	2	22	91	Room	
General air and breathing some During washing of chips.	Breathing somepouring other. General airother extraction.	enperes. Work levelpouring ether.	plating with 400-900 amperes. Breathing some and general sirall at 650.	Breathing some and general air Chromium	weather. Small fire in forge no work in progress.	Four Breathing some and twenty general air. Varying activity, mostly light, weather mostly cold. Little wentilation due to	precipitation. General airEast end of room: General airVarious sampling locations. General air.	General exhaust wentilator off. General airmaterial storagedenter of room. Breathing zone and general airarmonia	General air following armonia spill in Am. 22.	General exhaust wentilator off. Breathing sone and general airammonia General precipitation. New facilities being installed. Local	General airfollowing ammonia spill in Rm. 22.	Type of Sample and Process Operation	
General Exhaust with some Local	Send Same		SamePlus 1" Blanket of	Poor Local Exhaust	Hood above forge.	Doors opened occasion- ally to flush cut bad sir.	General Exhaust General Exhaust General Exhaust	No Personnel Present General & Local Exhaust	Wentilation. No Persennel Present		No Personnel Present	Protective Mossures	
œ	თ თ	2	of- 6	ဖ	-	22	₩ 64 70	÷ 2 -	_	c a	-	of Samples	Number
185	1,400 0	1,300	•58	5-8	o	190	250 242 7	7 0 26	79	268	80	Highest	Probabl
្ន	000	i	•01	0,10	:	0	: 63	::	1.	250	:	Lowest	Probable Air-Borne Concentrations
85	• •	1,200	0.30	1.8	. 1	· on	: 68 6	17	1	67	i	Median	e Concentr
	5 9 2	1,250	_		1	8	188 122	•••	;	189	;	Woen	ation

Cross Ventilation Responsible



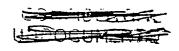
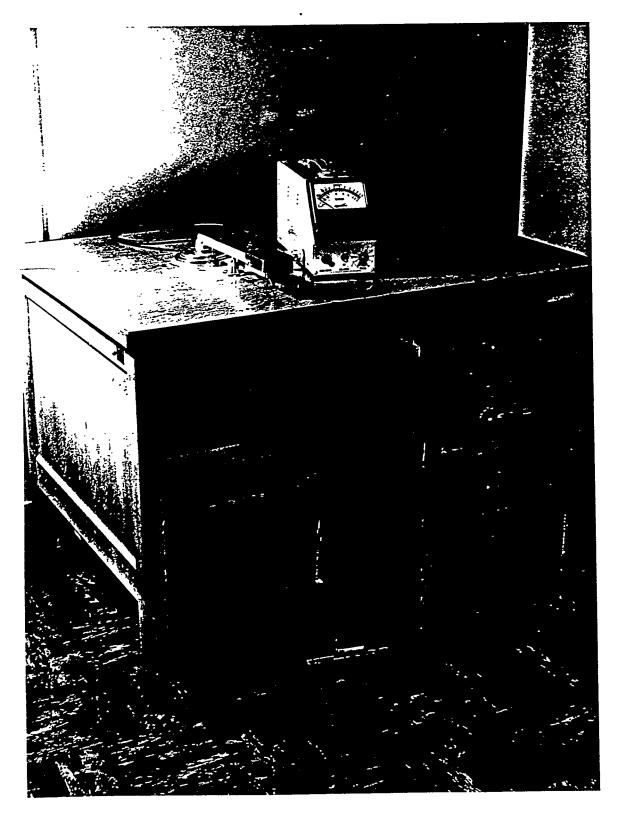


Figure 1







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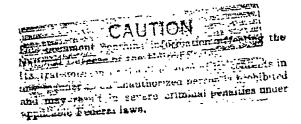
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BY Sh. M. Janks. DATE 9/4/47

HEALTH PHYSICS - HYGIENE PROGRESS REPORT

February 1 - 28, 1949

E. G. Struxness



Oak Ridge, Tennessee March 15, 1949

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HEALTH PHYSICS - HYGIENE PROGRESS REPORT

February 1 - 28, 1949

Part I - Introduction

A. General

A thorough investigation of the fluorimetric urinanalysis procedure, which has been in progress for the past two months, was completed during the period. The precision and reproducibility of the method are now well known. A similar investigation of the alpha count method for determining uranium in urine was started during the period and should be completed within the next month. This information is of the utmost importance in lending credence to our correlative study of urinary uranium and monitored data as well as providing a high level of confidence with which to report routine urinanalysis findings.

Weekly information meetings are being held with members of the Safety and Fire Departments together with the Plant Shift Supervisors to discuss problems in Health Physics monitoring and instrumentation. These meetings are scheduled to be held each Friday, from 2:00 to 4:00 p.m. It is hoped that these meetings will tend to further the interests and function of this department to the extent that intelligent cooperation, on the part of those now participating and others on the supervisory level, will follow.

A discouraging decrease in general activity of the department due to budgetary limitations and personnel losses has made itself evident and is reflected in this period report.

B. Organization and Personnel

R. W. Brothers, a Radiation Inspector, left the department at the start of the period for reasons not entirely his own. His leaving will decrease the effectiveness of our routine air surveys by an approximate factor of two. Within the present state of unstable affairs it is difficult to plan on a replacement. This loss reduces the number of individuals in the department exclusively concerned with Health Physics problems to four.

Part II - Health Physics

A. Routine Surveys

1. Air Surveys

Because of the general state of confusion and disagreement with respect to M.A.C.'s, in the minds of those who may have occasion to read this report, and others, and with specific reference to the M.A.C. of uranium in the atmosphere of 1225 d/min/M⁵ in effect at this site, the following information may be of interest. It is taken from a report by J. W. Morfitt (A-7.390.23 dated 2-7-47) and reflects the feeling of the department in this regard.



"The Maximum Permissibel Exposure to alpha radiation (considered from the standpoint of internal effects only) is 0.01 rep per day. From the value of the energy absorbed per gram of lung tissue, the energy of the emitted particle (4.27 Mev), the half-life of the element (assumed to be infinite); the biological half-life (two months), and the time a person is considered to be exposed to this element (assumed to be infinite), one can calculate the maximum allowable rate in curies per second at which uranium can be concentrated in the lungs to be 4.97 x 10-9. Then, taking into account a breathing rate of 150 cc/sec., one can calculate the maximum allowable concentration in the air of a room, assuming all the material in the air of that room gets into the lungs, viz., 3.3×10^{-11} AC/cc. Since only a fraction of the dust in the room is assumed to enter the lungs ("Biological Utilization = 25%), it follows that the air may contain 1/.25 times as much dust as would otherwise be possible. Furthermore, since the calculations are based on continuous exposure, a person exposed 40 hours per week can be subjected to an M.A.C. 4.2 times as great. Conversion of units (from μ C/cc to d/min/ M^3) by means of the definition of the Curie (3.7 x 10^{10} disintegrations per second) gives 1225 d/min/Mo. The calculation is a straightforward application of the methods developed by Dr. K. Z. Morgan of Oak Ridge National Laboratories."

That there is some disagreement or uncertainty in the field of health physics concerning "tolerances" is known. That this 1225 d/min/M³ level may be high (higher by a factor of approximately 20 when compared with maximum permissible level for Plutonium in the atmosphere) is also known. That this level may be inconsistent with those in effect at other sites and with specifications set forth in AEC Safety Regulation, No. 3 (see pp. 244 and 245) is admitted to this extent, viz., we do not agree that "for general safety and convenience other alpha emitters (other than Plutonium) should be considered at the same activity level."

A total of eighty-eight (88) samples of air-borne uranium were taken in eleven (11) different work locations during the period. Approximately 4% of these samples gave concentrations in excess of 150 mg/M while 8% indicated concentrations exceeding an activity of 1225 d/min/M . This represents a substantial improvement over results which have been reported in previous months. Table I. shows the location, process operation and range in measured concentrations of those samples taken during the period.

2. Water Surveys

Potable water, storm sewer (East Fork Poplar Creek) and sanitary sewer samples are taken regularly at predetermined frequencies and locations. The analytical results are tabulated below:

(a) Potable Water

Sample No.	Building	Uranium Conc. parts per billion	Counts (Alpha) per minute per 100 ml.
92	9720-5	<.005	1.6
93	9723-8	<.005	1.4 .
94	9733-4	<.005	< .5
95	9203	<.005	.5
96	9733-1	<.013	<1.
97	9206	C.005	<1.

(b) Storm Sewer

		ANALYS	ES*	
Sample No.	Uranium ppm	Activity uc/ml	Total Acidi ppm**	ty-CaCO ₃
80 85 85 86 87 88 89 90 91 92 93 94 95	.004 .008 .008 .018 .021 .009 .016 .009 .011 .020 .009	4 x 10 ⁻⁸ 3 x 10 ⁻⁸ 3 x 10 ⁻⁸ 2 x 10 ⁻⁸ 1 x 10 ⁻⁸ 1 x 10 ⁻⁸ 2 x 10 ⁻⁸ 1 x 10 ⁻⁸	107 127 112 103 131 97 109 108 107 131 101 91 99	7.2 7.8 7.7 8.4 6.6 7.8 7.7 7.6 7.7 4.5 7.3 7.4 7.5
	ang 1015	2.2 10 8		3000

*Relative Error (Confidence Level, 95%): Uranium (ppm) = 100%; Acidity = 10%

**0.0 ppm = pH 7.0

(c) Sanitary Sewer

		ANALYS		
Sample No.	Uranium ppm	Activity _uc/ml	Total Acidi ppm**	ty-CaCO ₃
77 77 78 79 80 81 82 83 84 86	.078 .006 .028 .076 .014 .025 .010 .017 .015 .006 .018	4 x 10 ⁻⁸ 2 x 10 ⁻⁸ 4 x 10 ⁻⁸ 4 x 10 ⁻⁸ 1 x 10 ⁻⁸ 1 x 10 ⁻⁸ 5 x 10 ⁻⁸ 5 x 10 ⁻⁸ 2 x 10 ⁻⁹ <1 x 10 ⁻⁹ 2 x 10 ⁻⁸	163 96 109 112 107 110 148 141 132 124 100	6.9 6.8 7.7 7.6 7.6 7.3 7.2 7.4 7.4 7.6

*Relative Error (Confidence Level, 95%): Uranium (ppm) = 100%;
Acidity = 10%
**0.0 ppm = pH 7.0

3. Site Surveys

(a) Midway Salvage Material

Approximately 1000 barrels of salvage material were moved to X-10 Burial Ground. The contamination level of this material was of a very low order.

(b) Room 17, Building 9206

Room 17 has been monitored regularly for air-borne uranium since the middle of July, 1948. The room has three major sources of



uranium dust, namely the crusher and lower end of conveyor, the chip table--dumping chips, and loading the press. A marked decrease in air contamination has resulted from (1) installing ventilation ducts over the crusher and raising the oil level in the crusher and (2) installing a hood over the chip tray. In Figure 1, the weekly average concentrations, obtained at these locations, are plotted.

(c) <u>Building 9204-1</u>

A survey has been made in that portion of the building to be taken over by ORNL. Measurements were taken on all equipment to be removed for use by the Y-12 maintenance department. That equipment requiring it will be decontaminated by Department M15P.

(d) Buildings 9203 and 9205

The radium-beryllium neutron sources in Room 8 of Building 9203 and in Building 9205 were checked for neutron flux. Between the "dog houses" in Room 8 there was a measured value of 1.03 mrep/hr of fast neutrons. In Building 9205 at a distance of one (1) foot in front of the channel mouth the measured value for fast neutrons was .85 mrep/hr. In both of the above locations the flux of slow (thermal) neutrons was very small, approximately .6 mrep/hr. The currently accepted tolerance for fast neutrons is 20 mrep/24 hr. day. Suggestions to reduce this are under discussion with a new value to be possibly as low as 3 mrep/week. Personnel in both buildings are being monitored with neutron-sensitive film. Neutron-sensitive film has also been placed in representative locations on walls in the rooms. The above measurements were made by Mr. W. H. Ray, Health Physics Consultant of Oak Ridge National Laboratory.

(e) C-1 Wing, Building 9212

Samples could not be taken at the power saw during the period (see January Progress Report) because maintenance work was in progress. It is expected that the local exhaust being incorporated in this installation will be completed during the coming month.

4. Shipment Surveys

Two hundred and fifty-four (254) lots of shipments were checked for alpha, beta and/or gamma activity in accordance with Standard Practice Procedure #20-A for release of property for shipment from Y-12 Area.

All of the electrical supplies and equipment in Warehouse 9913 was checked for alpha, beta and/or gamma activity prior to disposal as surplus property by the AEC. No detectable radioactivity, as measured by the Precision GM Survey Meter (Model 101) and Zeuto, was the criterion for determining the equipment available for surplus.

B. Special Studies

1. Urinary Uranium for Determining Degree of Exposure

The investigation of the fluorimetric method of analysis was completed. The two methods of extraction mentioned previously were further

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examined at the levels of .004 ppm and .020 ppm. The extraction from saturated NH₄NO₃ + HNO₃ was selected as the standard method because it gave slightly more consistent results and requires considerable less time. The results of this method for all three concentration levels are as follows:

Concentration	% Recovery	Variance Eetween Days	95% Confidence Intervalmean
.004 ppm .010 ppm .020 ppm	90 93 85	None None	.00330039 .00860100 .01630175

Since it was not possible to recover 100% of the uranium it was necessary to draw a calibration curve for the method at various concentrations of uranium. To obtain this, the analytical results were plotted against the actual concentration for 4 ppb., 10 ppb. and 20 ppb. This calibration is shown on Figure 2.

Work has just begun on the development of an accurate method of alpha count sample preparation. A standard solution containing 28 ppb. of uranium having a specific activity of 2748 d/min/ug was prepared by Mr. J. M. Googin. A total of eighty standards were extracted from uncontaminated urine, plated on stainless steel discs and counted. The results obtained bore little resemblence to the actual original concentration indicating the presence of gross errors. In order to pin down the errors the following program has been inaugurated:

- (a) To check the mechanism of counting, arrangements have been made to count the samples on a Keleket low background alpha counter in addition to the production counters.
- (b) To check the plating, standard water solutions containing a known quantity of uranium will be sent to the plating laboratory. These samples will not be extracted from urine and hence will not be subject to those possible errors.
- (c) To determine possible errors in extraction, standard solutions of uranium in uncontaminated urine will be made up. Following their extraction with penta ether, the organic layer containing the uranium will be evaporated on a stainless steel dish and counted. This will point out any discrepancy in extraction. Then another group of known samples will be extracted and backwashed with the water backwash evaporated and counted with the results indicating the efficiency of the backwash.

2. Air Sampling Methods

One of the Tornado air samplers is being rebuilt to run at low speeds for long periods of time. It will run at from one-half to one and one-half cubic feet of air per minute.

As soon as counting techniques are worked out using the new Keleket alpha counter, measurements will be made to find the efficiency of the new dust collectors. The tentative procedure will be (a) to take the dust sample and (b) count it in a parallel plate alpha counter; (c) then ash the sample and recount in the Keleket alpha counter. In this way some determination can be made of the amount of material which is





deposited in the filter paper and is not counted by the usual counting method. The three Electro-Lux Air Samplers are under construction and should be ready sometime in March.

3. Finger Pad Monitoring

The finger film pads are made on a special pad making machine. The machine completely assembles film pads, cutting and positioning the film discs on the rubber tape, sealing and cutting the rubber to form the pads. (Two pads are made simultaneously.) Another machine cuts the rubber for the finger ring and for the film pads. This second machine also punches a hole in the geometric center of the rubber strip used for the finger ring as it cuts the strip. The film pad is centered on the hole when the ring is worn and the pad is next to the work. (Figure 3)

Okolite tape, one inch wide, is used in making the pads. This tape was chosen because of its good adhesive properties. Gold Seal tape, three-fourths of an inch wide, is used in making the rings and was chosen because of its toughness.

At present an attempt is being made to correlate film blackening obtained on the finger rings to the average total body exposure. There is some evidence to indicate that the measured exposure to the hand of a "metal" worker is not the best index of total body exposure.

C. Personnel Monitoring

1. Alpha Hand Counts 1

Hand Count Totals. January 1 - 31. 1949

		Hand Count Tot	als, January 1 -	31, 194	19
Dept.	Total Left Hand Counts	Total Right Hand Counts	Total Left Hand Above-tolerance		Total Right Hand Above-tolerance Cout
A12W A14W A16N A20N B12H B12L H12D H12E M12P M15P	4 108 39 380 1,026 1,670 84 46 5,882 1,395	. 4 108 39 380 1,026 1,670 84 46 5,882 1,395	2 8 0 7 126 522 3 0 2,041 73		2 11 0 6 151 577 1 1 2,468 68
Totals	10,634	10,634	3,142		3,285

It is to be noted that these recorded counts (at least two per day at times when the hands are known to be grossly contaminated, i.e., just before lunch and at the end of the work shift) do not represent the degree of hand contamination at times when personnel leave the work area for lunch and/or when they leave the plant at the end of the work day. Operating procedures provide, with certainty for adequate decontamination before personnel are permitted to leave. Many hand counts are therefore not recorded.





2. Beta, Gamma Hand & Foot Counts, Bldg. 9212, C-1 Wing

Totals, February 1 - 28, 1949*

- 1 2 Table Hand County	402
Total Left Hand Counts	402
Total Right Hand Counts	201
Total Foot Counts	47
Total Left Hand Above-tolerance Counts	48
Total Right Hand Above-tolerance Counts	
Total Foot Above-tolerance Counts	13

*Hand and Foot Counter has been out of service for three weeks of the period for decontamination and minor repair.

3. Personnel Meters

- (a) A total of one hundred and one (101) film badges worn by personnel in the Assay Laboratories, Radiography Shop, Spectrograph Laboratory and "Metal" Machine Shops were processed during the period. The total number of pen chamber readings recorded was one thousand and fifty-two (1052). None showed evidence of exposure in excess of 50 mr per day.
- (b) A total of one thousand five hundred and fifty seven (1557) finger film pads were worn during this month. These pads are changed daily. One hundred and one (101) of these pads showed exposures of greater than 60 mr/day and less than 450 mr/day.
- (c) The decision was made in September of 1948 to avail ourselves of an additional personnel monitoring method, viz., wax finger ridge impressions, for personnel working in x-ray, spectroscopy and uranium machine shops. Accordingly, impressions were taken of forty-three (43) persons in the first week of September and sent to the University of Rochester for interpretation. It having been decided to repeat these impressions every three (3) months, another series of impressions were taken of seventy-four (74) persons in December. The reason for the increased number is explained by the expanded activities in the "metal" shops. No word has been received concerning the first set of impressions, but an effort is being made to locate them. The interpretations of the December moulages were received during this period and are summarized as follows:

It is to be noted that these <u>recorded</u> counts (at least two per day at times when the hands are known to be grossly contaminated, i.e., just before lunch and at the end of the work shift) do not represent the degree of hand contamination at times when personnel leave the work area for lunch and/or when they leave the plant at the end of the work day. Operating procedures provide, with certainty for adequate decontamination before personnel are permitted to leave. Many hand counts are therefore not recorded.



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No. of Subjects Participating	74
No. of Subjects Showing Prints Which Are	r
Suspicious in Any Way	5
No. of Individual Print Impressions	296
No. of Individual Print Impressions	
Showing No Suspicious Change	288
No. of Individual Print Impressions	
Showing Signs of Early Flattening,	6
Patch or Generalized Flattening	•
No. of Individual Print Impressions Suspicious for Early Flattening	2

The Medical Director has been advised of these findings and is preparing a disposition of these cases, the results of which will be made known to the AEC and the University of Rochester.

Part III - Instrumentation and Calibration

A. Instrumentation

The following instruments were obtained during February:

One (1) G. M. Survey Meter #101, Precision Radiation Instruments, Inc. Forty-eight (48) personnel film badges.
Ninety-six (96) Victoreen Pocket Chambers.

Part IV - Industrial Hygiene

A. Site Surveys

· A total of forty (40) samples were taken of air-borne contaminants. Table II shows the location, process operation, protective measures and range of measured concentrations obtained in these samples.

B. Urinanalyses

1. Summary of Analyses

A total of 10 spot analyses of plant employees were completed. None were over tolerance.

A total of 78 samples of standard solution were analyzed by the fluorimetric method during the standardization of that method.

A total of 84 samples of standard solutions were analyzed by the alpha count method. The results of these analyses had not been obtained at the end of the reporting period.

Esw. J. Klewines

ECL/jwo

TABLE 1. SAMPLE AIR-BORNE URANIUM CONCENTRATIONS

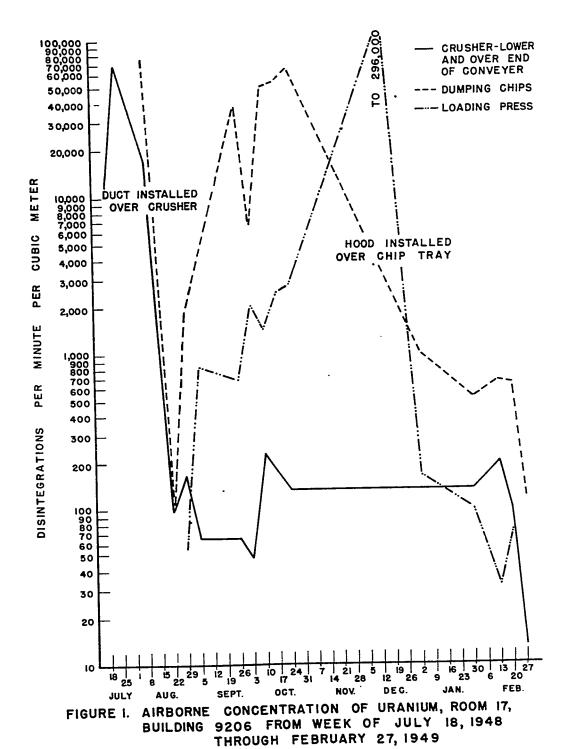
Pebruary 1 - 28, 1945

					Probable	Air-Borne Can	Probable Air-Borne Concentration in d/kin/Ar3	1212,A:3
				Number				
	Room	Type of Sample and Process Operation	Protestive Messures	of Samulas	HEhost	Lowest	Yedian	Keak
Aronne			Local Exhaust - Good	-	139.8	:	:	1
9206 17		General Air - "Chip" Recovery	General Exhsust		ç	70.B	110.1	122.7
		Parding Chips to Grusher	Local Syhaust		23		823.0	0.643
H		. Trey	Local Exhaust -	بى ب	1526	2	•	
⊢	17 F	STORTHING LOVE - CO.		uc.	92.26	0°0	55.8	48.0
. ~	17 1	Breathing Level - Feeding Chips to Press	Logal Exhaust - Respirators	• ;	3.48	63.8	222.5	418.1
,	₩.	General Air - Locel Exhaust Outlet on Boof . with Cottrell Precipitator Inoperative	Kone	a	4570	:	;	
	14	Breathing Level - Vacuuming Conteminerad Carbon Grucibles	Ses Merk - Local Exhaust	٠ ،	7021	;	818	1419
	#	General Air - "Metul" Recovery	None	, -	165	;	;	1
9212	44-D	Breathing Level - Loading Reactor in Dry Box	Good General Exhaust	• •	1 66		:	i
	46-D	Breathing Lovel - Unloading Static Caster		•	6600	₩	113.0	1710.0
	46-D	General Air - Casting "Metal"		•		•	8	146.0
		"Motol"	Good General Exhaust	ស	296	33	4.91	47.6
	46-3 46-0	Breething Level - medining "Metal" General Air - Machining "Metal"	Good General Sahaust	s -	1:1:1	÷ ;	;	;
	Cl Furnace Ayes	Breathing Level - Rotary Power Saw	Local Vaneus	5	26.0	;	:	1
	c, symace Area	General Air - Conting and Rough Cutting Wratel"	Local Exhaust - Good General Exhaust					

TABLE II. "ABOVE-TCLERAKCE" INDUSTRIAL HYGIEKR AIR SAMPLE CONCENTRATIONS

Pabruary 1 - 28, 1949

					Tumber	Probable A	Probable Air-torne Concentrations	orcentrati	į
Conteminant and . baxisum Allowehle Conc.	Building	Room	Type of Sample and Process Operation	Protective Wessures	Samples	Highest	Lowest	Yedian	K. K.
Ammonia K.A.C 180 ppm	\$20\$	22	lances Air and Brathing Zone - Armonia Precipitation	General Exhaust Only - Local Exhaust Bring In-	. , 10	8	80	130	£.
		106	General Air and Breathing Zone - Armonia Filtrate is Prepared for Oxidation	General Exhaust Only	٠.	2 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	v	166	183
•	9218	₹	General Air and Dreathing Zone - Ammonia Precipitation	General Exhaust Only	•	186	8	88	108
		46 13	General Air - Ammonia Precipitation	Hork Done in Hood -	~	168	! .	1	:
		ນ 8≯	Breathing 2022 - Arronia Precipitation	Mork Done in Hood -	-	120	i	:	:
Benseme M.A.C 1CO ppm	9787	L.V. Nein. Shop	General Air and Breathing Zone - Armeture Lacquoring	Kone	, eu	8 .	S S	-	85 85
Beryllium V.A.C010"g/m ³	9731	Track Wash Area	General Air and Dreathing S.ra - During Pemoral of Calutron from Tank, Trensfer to Dry Dock, Transfer to Nesh Area, Disessenbly and Weshing.	Cae Marks - Unnecessary Personnel Retricted - Good General Exhaust - Local Exhaust in Mash Area.	•	0	0.0	80 0	
Kitrefem Dioxide Y.A.C 25 ppm	9212	ာ	Tork Level - Leaching Operation	Nork Done in Rood Good Gemenal Exhaust Rubber Olerse Inter- mittent Operation.	.	\$:	;	:
Ferchlorethylene	9212	Q 9 7	General Air - Degressing "metal" chips	Work Done in Hood - Good General Exhaust.	.	100	1	:	i



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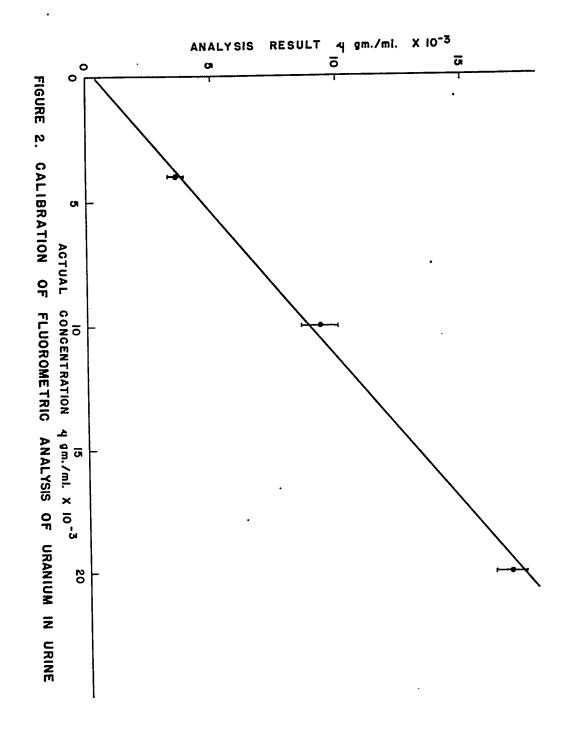






Figure 3.

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HEALTH PHYSICS -- HYGIENE PROGRESS REPORT

January 1 - 31, 1949

Part I - Introduction

A. General

Considerable work has been done on the urinanalysis program to determine procedural limitations and to increase the sensitivity of the flourometric method of analysis of uranium in urine. Some additional work has been done on the alpha count method using the Keleket Alpha Scaler. The film pad monitoring program is now in full force in Bldgs. 9212 and 9206.

B. Personnel

Miss Ruth was terminated on January 12, 1949. Her leaving the department was brought about by reason of ill health. No replacement has been effected at this writing.

Part II - Health Physics

A. Routine Surveys

1. Air Surveys

One hundred and eight (108) samples of air-borne uranium were taken in eleven (11) different work locations in accordance with the schedule previously reported. Approximately 21% of these samples gave concentrations in excess of the accepted M.A.C. of 150 µg/M³ while 44% showed concentrations exceeding the established radiation tolerance level of 1225 d/M³/min. in the following locations:

(a) Eldg. 9206

Fifteen (15) above tolerance concentrations were obtained during the following operations:

- (1) Room 17 Dumping chips into tray beside press.
 Around seal of centrifugal dryer while washing chips.
- (2) Room 36 Transferring dry oxide into carboy.
 Transferring green salt from charge box to carboy.
 General room concentration.
 - Vacuuming green salt out of charge boxes.
- (3) Room 41 Vacuuming out carbon crucibles.
- (4) Room 51 Unloading V.P. reactor bowls.
 Loading V. P. reactor bowls.
 General room concentration.



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(b) Bldg. 9212

Thirty-four (34) above tolerance concentrations were obtained during the following operations:

- (1) Room 44-D Cleaning slag from #3 dry box.
 - Knocking out reactors over #3 dry box.
 - Removing reactor from under #2 dry box.
 - Securing cover on reactor.
 - Over #2 dry box while filling reactor.
 - Cleaning out #3 dry box.
- (2) Room 45-D Unloading #3 static caster.
 - General room concentration.
 - Pressing brickettes.
 - Removing metal from carbon mold.
 - Removing mold from 3 caster.
 - Removing crucibles from #3 caster.
 - Breaking reject castings in press.
 - Removing cover from carbon mold.
 - Unloading #3 caster.
 - Unloading hot press.
 - Breaking buttons in press.
- (3) Room 46-D Machining uranium metal.
- (4) Room 48-D Leaching oxide with 50% nitric.

(c) Bldg. 9204-3

Seven (7) above tolerance concentrations were obtained during the following operations:

- (1) Chemical Recovery Brushing and washing liner.
 - Disassembling M unit.
 - Washing and steaming M unit.
 - General room concentration.

2. Water Surveys

Potable water, storm sewer (East Fork Poplar Creek) and sanitary sewer samples are taken regularly at predetermined frequencies and locations. The analytical results are tabulated below:

(a) Potable Water

Sample No.	Building		Alpha Counts per minute per 100 mJ.
89	9204-3	0	0.3 + 1.1
90	9720-2	0	0.4 - 1.1
91	9720-6	0	0.1 🛨 1.1



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(b) Storm Sewer

ANALYSES*

	Uranium	Activity	Total Acid	ity-CaCO3
Sample No.	ppm	uc/ml	ppm**	pН
79	0.017	1×10^{-8}	102	7.4
81	0.017	2 x 10 ⁻⁸	116	7.6
82	0.20	4×10^{-8}	118	7.5
83	0.097	2×10^{-8}	109	7.3
84	<0. <u>005</u>	5×10^{-9}	130	7.3
	Da 0.067	1.9×10-8		

*Relative Error (Confidence Level, 95%): Uranium (ppm) = 100%;

Acidity = 10% **0.0 ppm = pH 7.0

(c) Sanitary Sewer

ANALYSES*

	Uranium	Activity	Total Acid	ity-CaCO3
Sample No.	. ppm	/uc/ml	ppm**	pН
71	0.027	4×10^{-8}	102	6.4
72	0.20	3×10^{-8}	137	7.6
73	0.087	3×10^{-8}	131	6.6
74	0.20	4×10^{-8}	116	6.8
75	0.017	6 x 10 ⁻⁸	124	6.9
76	0.037	5 x 10 ⁻⁸	152	7.2

*Relative Error (Confidence Level, 95%): Uranium (ppm) = 100%;

Acidity = 10% **0.0 ppm = pH 7.0

3. Site Surveys

(a) Midway Salvage Material

Two hundred and ninty-two barrels of scrap materials were moved from Midway to Bldg. 9206. The December Progress Report erroneously reported the removal of only 80 barrels.

Ninty-five barrels of this number were disposed of at the X-10 burial ground.

(b) Room 17, Bldg. 9206

This room has shown a marked general improvement since the completion of a hood over the chip tray. In the February Progress Report there will appear a complete summation of the room. It is felt that Room 17 is adequately ventilated and exhausted now that the additional facilities have been installed.



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(c) C-1 Wing, Bldg. 9212

A hood was installed over the new power saw during the period. Air samples are being taken to check on the expected improvement in air contamination at this location. Additional ventilation facilities will be installed in the Casting Area during the month of February.

(d) Alpha Buildings

The silver buss bars in all the alpha process buildings were spot checked for contamination. Some were found to be slightly contaminated, this being due perhaps to contaminated dust which has settled over the period of the last five years. It is expected that little difficulty will be encountered in decontamination.

(e) X-Ray Building, 9212 Area

The radiographic installation was completed during the month and, while preliminary tests were being run, the building and surrounding area were monitored. Measurements were taken outside the building with the x-ray machine operating at 1000 KV, 3 MA, the machine as close as possible to and directed towards the wall. The maximum reading obtained was .2 mr/hr. Similar measurements were made directing the x-ray beam towards the 20 inch inner wall to which, during normal operation, access is impossible. The x-ray machine was as close to the wall as possible and directed towards the wall. The interlocks of the outer lead door were locked and measurements made inside the corridor. The maximum readings obtained were 12 mr/hr at the surface of the wall. From this it can be seen that the concrete shielding is more than adequate. Personnel working in this building will wear film badges and pocket chambers.

(f) Radiography Shack, 9212 Area

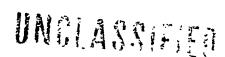
A 10 curie cobalt source, obtained from Oak Ridge National Laboratory, was lowered by remote means into the lead bomb of the radiography shack. All metering and personnel monitoring during the transfer indicated that none of the four persons involved were exposed to penetrating radiations.

The maximum measurement obtained at the outside surface of concrete and lead shielding surrounding the building after installation of the cobalt was 0.6 mr/hr.

4. Shipment Surveys

Two hundred and seventeen (217) lots of shipments were checked for alpha, beta and/or gamma activity in accordance with Standard Practice Procedure #20-A for release of property for shipment from the Y-12 Area.







B. Special Studies

1. Urinary Uranium for Determining Degree of Exposure

During the past two months considerable effort has been given to (1) determine the limitations and (2) increase the sensitivity of the flourometric method of analysis of uranium in urine. A statistical study of the method was made at the level of .01 ppm with a total of 97 analyses of 5 standard solutions being run over a period of two weeks. The statistical study indicated the following:

- (a) The average recovery was 59%, i.e., the average result of the analyses of the standard solutions indicated a concentration of .0059 ppm.
- (b) Although the standards were evidently not all .01 ppm, it was easily proven that the difference among the results between days was far in excess of the difference in results within any one day. This seemed to indicate that the analyses were not being performed in exactly the same manner each day.
- (c) Due to the large variance of the results between days it appeared that no concentration below .005 ppm could be detected with 95% confidence. This seemed to be the lower limit of sensitivity.

In order to reduce the lower limit of sensitivity the procedure was examined to determine the reasons for the losses that were occurring. Several changes were instituted on all subsequent runs:

- (a) The compounding of new flux which gave a blank of less than one-half that of the old fusion flux.
- (b) The mechanical agitation during extraction with its great risk of spillage was abandoned in favor of a one minute manual shake.
- (c) The flourometer was to be read approximately one hour after being turned on in order to achieve stability and uniformity of results.

In addition to the above changes the NH₄NO₃, the salting out agent, from which the uranium is extracted, was made I N in HNO₃ because the distribution coefficient² rises markedly as acid is added.

Five known samples a day for five days were analyzed by this method and five more by using sat. $\mathrm{NH_4NO_3} + \mathrm{Fe(NO_3)_3}$ as a salting out agent. The results are as follows:

2 The ratio of uranium in the penta ether to the uranium in the ammonium nitrate.



 $^{^{1}}$ V_a, the variance of the result = $(\frac{1 \cdot 1}{2} + \frac{1 \cdot 6}{2})$ 10^{-6} where a = number of alequots and d = number of days the analysis is run.



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			•	% Recovery	Variance Between Days	
Set I	-	Sat. NH ₄ NO ₃	+ HNO3	93	None	$(\frac{2\cdot 2}{a})$ 10 ⁻⁶
Set II	_	Fe(NO ₃) ₃ +	Sat. MH4NO3	119	None	$(\frac{2.2}{a})$ 10 ⁻⁶

The per cent of recovery is very close to 100 in both cases and the variance between each days results has disappeared at this time. Both methods will be examined at the Tevels of .004 ppm and .020 ppm and then it will be decided which of the two variations in procedure will produce the more consistant results.

2. Air Sampling Methods

Three "Tornado" Air Samplers were received. The department had been without a "Tornado" for sometime. Early measurements using a "Tornado" were made with a machine on loan from K-25. The alpha counters used in counting air samples are being studied further.

3. Film Pad Program

A total of 1912 finger film pads were worn during this month. These pads are changed daily.

Two finger rings were worn during this month. The rings are worn one week. It was necessary for one person to wear a film ring because he is allergic to the rubber of the film pads.

C. Personnel Monitoring

1. Alpha Hand Counts

Mand Count Totals, December 1 - 31, 1948

	Total Left	Total Right	Total Left Hand		Fotal Right Hand	
Dept.	Hand Counts		· Above-tolerance		Above-tolerance Cou	ınts
		:	•	:		
A12V	14	! 14	: 4	!	4	
Al4N	154	i 154	18	:	20	
Al6N	44	44	0	:	0	
AZON	434	434	1		1	
B12C	1441	1441	155		16 5	
B12H	2600	2600	224	:	229	
Bl2L	1536	1536	44 6	:	45 3	
H12D	309	309	21	;	21	
H12E	. 31	31	0		0	
H12L	: 153	153	1 .	•	· 2	
M12P	5842	5842	1636	_	1704	
M13P	27	27	1	•	2	
M15P	356	356	17		17 .	
Totals	12,941	12,941	2,524	:	2,624	

It is to be noted that these recorded counts (at least two per day at times when the hands are known to be grossly contaminated, i.e., just before lunch and at the end of the work shift) do not represent the degree of hand contamination at

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2. Beta, Gamma Hand & Foot Counts, Bldg. 9212, C-1 Wing

Totals, January 1 - 31, 1949

Total Left Hand Counts	4564
Total Right Hand Counts	4564
Total Foot Counts	1141
Total Left Hand Above-tolerance Counts	112
Total Right Hand Above-tolerance Counts	105
Total Foot Above-tolerance Counts	17

3. Personnel Meters

A total of one hundred (100) film badges worn by personnel in the Assay Laboratories, Radiography Shop, Spectrograph Laboratory and "Metal" Machine Shops were processed during the period. The total number of pen chamber readings recorded was 1,100. None showed evidence of exposure in excess of 50 mr per day.

Part III - Instrumentation and Calibration

A. Instrumentation

The following instruments were obtained during January:

Two Cutic Pies
Three "Tornado" Air Samplers
One Victoreen Proteximeter
One Densichron Densitemeter
One Keleket I. C. Alpha Scaler*
Five 10 r Keleket Pocket Chambers*

*On field test from AEC Instruments Branch.

B. Calibration Shack

Plans for the calibration shack are being drawn up. Present plans call for a well fifteen (15) feet deep for a 150-200 curie cobalt source for calibrating survey meters. A 25 mg source of radium will be used to calibrate personnel meters.

Part IV - Industrial Hygiene

A. General

Two additional substances, mercury and beryllium, were included in site surveys during January. The beryllium results, being incomplete, are not included in this report. They will, however, be included in the February Progress Report. A General Electric Mercury Vapor Detector was borrowed from the K-25 Industrial Hygiene Laboratory for use in determining Hg measurements.

Ttimes when personnel leave the work area for lunch and/or when they leave the plant at the end of the work day. Operating procedures provide, with certainty, for adequate decontamination before personnel are permitted to leave. Hany hand counts are therefore not recorded.

B. Miscellaneous

1. Two reports were issued as follows:

To	Subject
Dr. C. P. Koim	Uranium Hexafluoride Charge Material, XEX
Dr. C. P. Keim	Use of Barium Oxide in Bldg. 9731

- Background information, relative to an early alleged occupational injury, was obtained for Mr. Clyde Vilson of AEC Insurance Office. Similar information, relative to three other cases, was obtained for Mr. J. Fred Brehm, also of the AEC.
- 3. One hood check was made in conjunction with Project 24. Although some decrease in efficiency was finally noted, it was found adequate for concluding the present project without need for a filter change.

c. Site Surveys

1. Ammonia (M.A.C. - 100 ppm)

Bldg.	Room	Conditions	ppm
9206	21 22	General air General air General air	58 81 19
9212	25 46 - A	General air, during batch preparation Breathing zoneduring ammonia precipitation General airapproximately 2 ft. in front of	>600(Ist) 58 39
	46-B 47-A	hood General airSE corner General airN center of room	35 53

2. Benzene (M.A.C. - 100 ppm)

Bldg.	Room	Conditions	ppm
2246.			^
9737	L.V.Shop	General airtank closed	0
	-	General airE end, tank open	70
		General airBetween dip tank & lathe at E. wall	60
		General airBetween open dip tank & N. wall	50
		Breathing zoneKork bench at N wall near tan	k 40
		General air-Approx. 20 ft. WSW from open dip	20
	•	tenk	
		General airApprox. 15 ft. SW of open dip to	nk 20
		General air In Instrument Shop, near LVS	10
		General air In hallway just E of entrance	10
		to Instrument Shop	
		General airIn hallway opposite stock room	20
		window	10
		General air E end of hallway through bldg.	10
		General air Toward W end of room	3 0
		General air approx. at center of room	20
		General air In office section, SE corner of	3 0
		room	



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2. Benzene (Cont'd.)

Bldg.	Room	Conditions	ppm
9737	L.V. Shop	General airSE area of room General airN central area, approx. 2 min. after dip tank closed	3 0 3 0
		General air Between tank and drying oven	30
		Breathing zone In front of closed dip tank	20

3. Carbon Monoxide (M.A.C. - 100 ppm)

Bldg.	Room	Conditions	ppm
9738	Foundry	General air Melting badges in furnace	0

4. Carbon Tetrachloride (M.A.C. - 100 ppm)

Bldg.	Room	Conditions	ppm
9709	Sheet Bre Metal Shop	athing zoneat open tank	32

5. Mercury (M.A.C. - 0.1 mg/m 3)

Bldg.	Room	Conditions	mg/m^3
9206	Sub-store	General airnear former mercury spills	0
		Breathing zoneat same location	0
		Work levelat shelving	0
9706-2	Lab.	General airat site of former spills	0
9720-5	Vault	General airat dirty mercury storage area	0
		Breathing zonenear storage containers	0
		Work level at storage containers	0
		Floor level1/8" above former spills	0.6
9733-3	1	General airformer mercury cleaning station	0
		Breathing zoneat N hood over muffles	0
		Work level1" above table, under muffles	0.1
		Breathing zone-at hood over screening table	0
		Floor level1" above N center floor drain	1.2
		Work levelIn low ss sink formerly used	0
		Floor level1" above S center floor drain	0.4
		General airS center of room	0
9737	McLeod Gauge	General airentrance room, door closed, vent off	. 0.05
	Shop	General aircleaning room, door closed, vent off	. 0.06
		General aircalibration room, door closed, vent. cff	0.07
		General air same room, fan on for 5 min.	0.03
		Breathing zonesame room, in hood	< 0.03
		Breathing zonecleaning room, in hood	<0.03
		Breathing zoneat final assembly bench	0.07
		General air entrance room, in original posit	ion0.07
		General air door open, fresh air coming in	0.03
		General airin mercury storage room	0.03



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6. Miscellaneous Metals

Bldg.	Room	Conditions	
9738	Furnace	Ereathing zonemelting badges	Al- trace Ca- 10.6 Cu- 0.2 Mg- 0.7 Si- trace

7. Nitrogen Dioxide (M.A.C. - 25 ppm)

Bldg.	Room	Conditions	ppm
9206	22 34 47-C	General airN central area General airCenter of room Breathing zoneopen drum nitration work levelsame, reactor in S central area Breathing zonewater washing in hood Breathing zoneevaporation under hood	19 17 120 160 2 < 0.5

Perchlorethylene (M.A.C. - 200 ppm)

Bldg.	Room	Conditions	ppm
9206	17	Breathing zonebetween centrifuge and recirculating tank	93

Urinanalyses

Summary of Analyses

Total number of samples analyzed	134
Samples analyzed by Fluoremetric !'ethod	24
Samples analyzed by alpha count method	110
Samples analyzed by alpha count in the	

Alpha count results have not been returned from the Counting Laboratory, so no breakdown of degree of contamination can be made.

Figure 1 indicates the results of urinanalyses for uranium by the flucrometric method of all personnel checked for uranium contemination during the months of October, Nevember, December, 1948 and January, 1949.

Figure 2 shows the results of all urinanalyses for uranium by the alpha count method of personnel handling enriched uranium during the months of October, November, and December, 1948. Lach point represents the average of duplicate samples.

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E. G. Struxness



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CARBIDE AND CARBON CHEMICALS CORPORATION

Y-12 PLANT

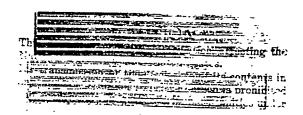
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HEALTH PHYSICS - INDUSTRIAL HYGIENE PROGRESS REPORT

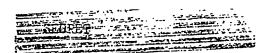
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E. G. Struxness



Oak Ridge, Tennessee January 11, 1949



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HEALTH PAYSICS--INDUSTRIAL HYGIENE PROGRESS REPORT

December 1 - 31, 1948

Part I - Introduction

I. GEMERAL

During the early part of the period the survey of unused buildings was completed. Results are incomplete but it is expected that final tabulation of data will be ready sometime during January, 1949. The department no longer has the three persons borrowed from Department Bl2H for the survey work.

Part II - Health Physics

I. ROUTINE SURVEYS

A. Air Surveys

One hundred and twenty-four (124) samples of air-borne uranium were taken in fourteen (14) different work locations in accordance with the schedule previously reported. See Report #Y=138 dated 3-9-48. Approximately 46% of these samples gave concentrations in excess of the accepted M.A.C. of 150 Mg/M⁵ while 27% showed concentrations exceeding the established radiation tolerance level of 1225 d/H³/minute in the following locations.

(1) Building 9206

Seventeen (17) above tolerance concentrations were obtained during the following operations:

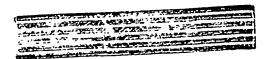
- (a) Room 6 Removing trays of contaminated ash from muffle furnace.

 Vacuuming out trays from muffle furnace.
- (b) Room 17 Dumping chips in tray and raking over screen.
 Over chip tray while pressing brickettes.
- (c) Rocm 31 Over furnace while burning paper salvage.
 General rocm concentration.
- (d) Room 41 Vacuuming out carbon crucibles.
 General room concentration.

(2) Building 9204-3

Two (2) above tolerance concentrations were obtained during the following operations:

- (a) Major Repair Area Cleaning manifold with Spencer vacuum cleaner and brush.
 - General room concentration.



(3) Building 9212

Forty-seven (47) above tolerance concentrations were obtained during the following operations:

- (a) Room 45-D General room concentration.
- (b) Room 59. C-1 Wing Around portal between #1 & #2 dry box while transferring green salt from #1 to #2 dry box.
 - Around seels of #2 dry box while loading reacto:
 - Removing reactor from #2 dry box and caping.
 - Removing cap from reactor.
 - Unloading reactor in #3 dry box.
- (c) Furnace Room, C=1 King Removing lid and fire brick off #2 furnace
 - Removing carbon crucible from #2 furnace.
 - Removing bottom lid and casting from #2 furnace.
 - Dipping casting into drum of water,
 - Breaking carbon off metal casting.
 - Removing carbon crucible from #1 furnace.
 - Removing metal casting from #1 furnace.
 - General room concentration.
 - Transferring carbon from dollie to drum.
 - In front of saw while sawing metal casting
 - Over saw while sawing metal casting.
- (d) Machine Shop, C-1 Wing Machining metal casting.
 General room concentration.

B. Mator Surveys

Storm sewer (East Fork Poplar Creek) and sanitary sewer samples are taken regularly at predetermined frequencies and locations. The analytical results are tabulated below:

(1) Storm Sewer

		ANALYSES*		
	Uranium	Activity	Total Acid	ity-CaCO3
Sample No	ppm	ac/ml	ppm**	₽Ħ
75	0.017	2 = 10 ⁻⁸ 1 = 10 ⁻⁸	88	6,7
76	₹ 0。005	1 x 10 ⁻⁸	130	7 - 1
77	0.028 .	5 = 10 ⁻⁹	87	75
78	0,30	4 × 10 ⁻⁸	107	7.9
	0.375	1.8 × 10 - 3		

*Relative Error (Confidence Level, 95%): Uranium (ppm) 2 100%; Acidity 2 1 ***0,0 ppm 2 pH 7.0



(2) Emmitary Newer

		· ANALYSES*		
	Uranium	Activity	Total Acid	ity-CaCO,
Sample No.	DDM	uc/ml	ppm**	pli
65	0.010	2 x 10 ⁻⁸	92	7.4
63	∠ 0.005	2 x 10 ⁻⁶	93	5.6
67	0.012	1 x 10 ⁻⁸	204	6.8
68	∠0,005	3 x 10 ⁻⁸	155	7
69	<0.005	2 x 10 ⁻⁸	158	6.9
70	0.013	2×10^{-8}	141	6.7

*Relative Error (Confidence Level, 95%): Uranium (ppm) = 100%; Acidity = 10% **0.0 ppm = pH 7.0

C. Site Surveys

(1) Midway Salvage Material

Approximately 80 barrels of salvage material were moved to an open area behind Bldg. 9206. This was the salvage material noted in October, 1948, progress report.

(2) Room 17, Bldg. 9206

A hood has been installed over the "chip" dry tray resulting in a very marked improvement.

(3) Building 9202

This is the last of the stand-by buildings to be surveyed at present. The survey is completed and results are being tabulated.

D. Shipment Surveys

Two hundred and thirty-four (234) lots of shipments were checked for Alpha, Beta and/or Gamma activity in accordance with Standard Practice Procedure #20-A for release of property for shipment from Y-12 Area.

II. SPECIAL STUDIES

A. Urinary Uranium for Determining Degree of Exposure

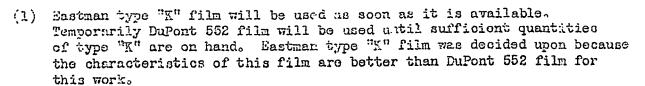
A statistical study is being made to determine the accuracy of the fluorimetric method of analysis at the concentration of .010 Agn/ml. Standard camples were sent through and checked, and variations were noted.

Bo Air Sampling Methods

The study of air sampling methods was temporarily put aside in order to start the film pad monitoring program.

C. Film Pad Monitoring

It is planned to initiate the film pad program in 9212 beginning January 3, 1949. Studies of the problem during December, 1948, indicate the following:



- (2) General Electric X-Ray film developer and Kodak Rapid Fix will be used.
- (3) The machine used for making film pads was designed and built in Y=12. (Report on Film Pad Maker to be written soon.)
- (4) Okolito rubber tape one inch wide will be used in making the pads and holding pads on fingers.
- (5) The darkroom in Bldg. 9203 will be used for the present.
- (6) Some 100 film pads will be made, usod, developed, and read per day.
- (7) Film pads must be calibrated at predetermined intervals, possibly each day.

D. Personnel Badge Monitoring

The problem of personnel badge monitoring is being renewed. Three sets of calibrated film will be made each two weeks. Calibrations will be made for x_0 -rays, radium, and uranium.

The personnel badges are now being developed by Health Physics personnel.

As work progresses it is becoming more obvious that a calibration shack is needed for calibrating film pads and film badges.

III. PERSONNEL MONITORING

A Alpha Hand Counts

Hand Count Totals, November 1 - 30, 1948

Dept	Total Left Hand Counts	Total Right Hand Counts	Total Left Hand Above-tolerance Counts	Total Right Hand Above-tolerance Counts
4.3.07"	7.4	2.4	4	3
Al2W	14	14	=	3
Al3N	15	15	0	U
Al4N	101	101	7	4
A15N	90	90	3	3
Algn	130	130	85	85
Al7n	14	14	0	0
AZON	255	255	1	1
B12C	1936	1936	276 ⁻	276
B12H	3637	3637	369	379
Bl2L	1114	1114	30 8	314
H12D	394	394	6:0	60
H12E	211	211	10	12
H12L	248	248	0	0
M12P	2909	2909	522	557
M13P	526	526	134	165
Totals	33 504		7 770	
1700073	11,594	11,594	1,779	1,863





B. Beta, Gemma Hand & Foot Counts, Bldg. 9212, C-1 Wing

Totals, December 1 - 31, 1948

Total Left Hand Counts	1794
Total Right Hand Counts	1794
Total Foot Counts	897
Total Left Hand Above-tolerance Counts	79
Total Right Hand Above-tolerance Counts	87
Total Foot Above-tolerance Counts	145

C. Personnel Meters

A total of two hundred and seven (207) film badges worn by personnel in the Assay Laboratories, Radiography Shop, Spectrograph Laboratory and "Metal" Machine Shops were processed during the period. The total number of pen chamber readings recorded was 1,038.

D. Finger Impression Plates

The quarterly finger impression plates were made during this period. Eighty-two (82) sets of impressions were taken and sent to the AEC office of Medicine and Research, Oak Ridge, Tennessee.

Part III - Industrial Hygiene

I. GENERAL

Relative to the analysis of samples, Miss M. Barnes has succeeded Mrs. M. Poore who formerly did this work.

II. HISCELLANEOUS

- A. Further assistance relative to urinanalysis procedure, and/or background information, was given to Mr. Ross.
- B. A hood study was made at Bldg. 9733-3, Room 14 following a fire at that location. Several deficiencies were noted, and these were given verbally to Mr. E. Bentley of the Safety Department. A later visit revealed that some action had been taken.
- C. An investigation was made in Bldg. 9202 to determine whether an eye injury was due to paint fumes. Vita-Var lead paint with special thinner was being used. No indication of toxic or irritant fumes was apparent and this information was given verbally to Dr. A. R. Robinson of the Medical Department.
- D. Proparations are substantially complete for making fluoride, beryllium and mercury determinations in air. It is planned to initiate an investigation of these materials in the near future.



III. SITE :URVEYS

... Ammonia (M.A.J. - 100 ppm)

Bldgo	Room	Conditions	ppm
9205	21	Breathing zone during ammonia precipitation General air	160 60
		General air near open storage drums	168
	22	General air-open drum in room	52
		Breathing zone-drawing from drum	164
		Breathing zoneoperator kneeling	618
		General air	102
		General air	119
		Breathing zone-during open drum processing	64
	25	Breathing zone-mixing ammonia and oxide	73
		Breathing zone-cleaning filter press	64
		Genoral air-oxide preparation	20
2222	2	Breathing zoneoxide preparation	40
9212	6	Genoral air	75
	12	General air	54
	46 ∞A	Breathing zone filtering (in hood)	102
	46-B	Breathing zone-decanting and filtering	192
		Breathing zonedecanting 1st ammonia wash	56
	47-A	Breathing zone-ammonia complexing	7 7 7
	ZI OA	General air(open beakers on center table)	155 155
		Breathing zone ammonia precipitation Breathing zone peroxide precipitation	75
		General air	89
	47-B	Breathing zoneextraction process	56
	21-5	Breathing zone-extraction, center table	8
		Breathing zone-same, at end of table	30
		General air	58
		Breathing zoneat center table	59
		General airzeveral operations going on	130
		and the state of t	

F. Benzene (M.A.C. = 100* ppm)

Blog.	Reon	Conditions	ppm
9737	L.V.Shop	General air-tank closed and not thinned Breathing zone-tank open and still unthinned Breathing zone-above tank, benzene drum delivering	10 20 40
		General air-same, after several minutes	140
		Breathing zone-tank still open, but drum removed.	290
		Breathing zoneseveral minutes later, stirring mixture.	540
		General air tank closed, after ten minutes	10
		General airtank closed	0
		Broathing zone-immediately after opening (and then closing) tank	790
		General air - tank closed	10

^{*}This N.A.C. is currently under wide criticism as being something like three (3) times too high.





C. Carbon Monoxide (M.A.C. = 100 ppm)

Bldg	Room	Conditions	ppm
9712	Garage	General air-elittle activity General air-every little activity	20 0
9738	Foundry	General air-oforging Breathing zone-with fire covered to produce amoke	0 10

D. Carbon Tetrachloride (M.A.C. = 100 ppm)

Bldg.	Room	Conditions	ppm
9709	Sheet Metal Shop	Breathing zone-degreasing tank open	1.2

E. Mitrogen Dioxide (M.A.C. = 25 ppm

Bldg.	Room	Conditions	ppm
9206	6	General air-muffling in process	ı
		Breathing zone-eat salvage barrel	4
		Breathing zone opposite muffles	3
	25	Breathing zone-leaching (under hood)	1
		General air	2
		Breathing zone cleaning can of oxide	6
	34	Hork level stripping a cans in hooded exhaust	Decomposed sampling
•			reagents
		Breathing zonestripping a cans	26
		Breathing zone running stripped a cans	5
		Breathing zoneleaching process material	2.6
		Breathing zone-before parts stripping bin	3
		Breathing zoneleaching process solutions(hood	led)2
		· Breathing zone-experimental leaching (formerly in room 110)	
		Work level same, water washing in hood	60
		Breathing zone-same except before hood	4
	40	General air	5
	62	Breathing zonecentrifuging	4
	111	General airoutside room 113	15
	106	General air extraction process	4
	111	General airoutside room 113	14
	113	Breathing zoneexperimental (2nd) leaching, respirators worn	95
	·	General airsame	44
		Breathing zonesame	88
		General air-ten minutes after 2nd leaching finished	1.5
		Breathing zone near experiment in NE corner	11
		Breathing zonesame	14
		General air-center of room	10
		Breathing zoneSE corner of room	19
9212	46-A	Breathing zoneBuckmer filtering	4
		Breathing zoneregular (lab) filtering-hooded	3
	43	General air-arc welding on stainless tank	∠ 0 ₀ 5
		Breathing zone-same	1,0



3,

Nitroger	.A.M) ebizoid a	C 25 ppm) Contid.	
Eldg.	Room	Conditions	ppm
9212	43	Work levelsame General airarc welding on stainless cylinder Breathing zonesame Work levelsame General airhot rodding stainless plate Breathing zonesame Work levelsame	4.5 <0.5 <0.6 7.0 1.0 2.5
9709	Welding Shop	General air-Electro-Welding stainless and black iron Breathing zone Work level-same General air-same, SE corner Breathing zone-same Work level-same Breathing zone-central area General air-SE corner-mild steel Breathing zone-same Nork level-same	 ✓ 0.5 7 ✓ 0.5 2 2 2 2 2 3 2 5 1
9733-3	13	Breathing zone-analysis in progress	1 2
9733-4 Perchlo	101 rethylene (M.A. Room	General air-salvage storage Conditions	ppm
9206	16	General air-at open drum near E wall	29 84

 \mathbb{F}_{\circ}

Bldg.	Room	Conditions	ppm
9206	16 17 39 108	General air-eat open drum near E wall Breathing zone-centrifuge (drying) operation Breathing zone-centrifuging (#2 wash) Breathing zone-same, leak in line Breathing zone-same, between 1st & 2nd wash General air-eno operations General air-eno activity	29 84 37 56 150 19 35

G, Sodium Sesquicarbonate (M.A.C. - None established)

<u>Bldg</u>	Room	Conditions	ppm
9709	Welding Shop	Flux analysis (essentially pur Na ₂ CO ₃ with $2\frac{1}{2}$ moles H ₂ O per mole Na ₂ CO ₃ . Work level"Airco" flux injection Breathing zonecutting stainless General airimmediate area General airsurrounding area	250 43 56 47

H. Trichlorethylene (M.A.C. = 200 ppm)

Bldg.	Room	Conditions	ppm
9204 - 3	Mech. Serv.	Ereatling zone at opened degreaser	130
973?	L.V.Shop	Same	130





IV. URINAMALYSIS

A. Summary of Analyses

Total number of samples analyzed	176
Total number of alpha count samples	92
Total number of fluorimetric analysis	84
Total number of samples showing heavy exposure	0
Total number of samples showing moderate exposure	0
Total number of samples showing light exposure	16

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E. G. Struxness

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HEALTH PHYSICS - INDUSTRIAL HYGIENE PROGRESS REPORT

November 1 = 30, 1948

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E. G. Struxness

Oak Ridge: Tennessee December 15: 1948



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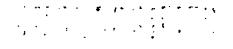
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HEALTH PHYSICS -- INDUSTRIAL HYGIEME PROGRESS REPORT November 1 - 50, 1948

Part I - Introduction

I. GENERAL

During this period the survey of unused buildings for radioactive contemination was continued. It is expected that this survey will be completed in the early part of December, 1948.

II. ORGANIZATION AND PERSONNEL

Mr. Ross, on loan from Department H12E, has temporarily taken over the urinary uranium determination program. An equipment washer is also on loan to the department.

Part II - Health Physics

1. ROUTINE SURVEYS

A. Air Surveys

One hundred and ninty-seven (197) samples of air-bourne uranium were taken in sixteen (16) different work locations in accordance with the schedule previously reported. See Report #Y-158 dated 3-9-48. Approximately 23% of these samples gave concentrations in excess of the accepted M.A.C. of 150/mg/M⁵ while 28% showed concentrations exceeding the established radiation tolerance level of 1225 d/M⁵/minute in the following locations.

(1) <u>Building 9208</u>

Forty-four (44) above telerance concentrations were obtained during the following operations:

- (a) Room 6 Over mulfile furnace tray while vacuuming out crucibles.

 Mear exhaust of vacuum cleaner while vacuuming out crucibles.
- (b) Room 31 Bottling and sampling white salt in dry box.
 Removing white salt from muffle furnace.

- General Room Concentration.

- Transforring white salt from muffle furnace to dry box.
- (c) Room 33 Screening 1300 re-cycle solid salvage.
 Grinding 1300 solid salvage.
- (d) Room 41 General room concentration.
 - At exhaust of Pilter ween while vacuuming crucibles,
 - Removing crucibles from oven.
 - Transferring exide from oven container to open container.
 - Removing plug from bettem of crucible.





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(2) <u>Lailding 9204-3</u>

Ten (10) above telerance concentrations were obtained during the following operations:

- (a) Chemical Recovery Cashing of 1300 re-cycle liner.
 General room concentration.
 Steeming 1300 re-cycle liner.
- (b) Carbon Grinding Room Grinding re-run carbons.

(3) Building S731

One (1) above tolerance concentration was obtained during the following operation:

(a) Chemical Lab. - Adding calcium hydroxide to uranium solution.

(4) Building 9212

Fifteen (15) above tolerance concentrations were obtained during the following operations:

- (a) Room 45-D Chipping carbon from moulded metal.
 - Unloading #2 caster.
 - Removing metal from mould.
 - Unloading #3 caster.
 - Breaking buttons in press.
 - Placing skulls from dry box into salvage can.
 - Removing casting cover.
 - Unloading #1 caster.
- (b) Room 46-D General room concentrations.
 Machining metal.
- (c) Furnace Room C-l Blowing carbon dust out of crucibles.
 - Dipping metal casting into drum of water,
 - Removing lid and fire brick from #1 furnace.
 - Around outlet of carbon dollie while breaking carbon off casting.

B. Later Surveys

Potable water, storm sewer (East Fork Poplar Creek) and sanitary sewer samples are taken regularly at predetermined frequencies and locations. The analytical results are tabulated below:

(1) Potable Later

Sample No.	Building	Uranium Conc. parts per billion	Alpha Counts per minute per 100 ml.
84	9733-3	O	0.2 ÷ 1.1
85	9704-1	0 🏕	0.2 + 1.1
36	9706-2	o ·	0.0 7 1.1
87	9204-3	0	0.3 7 1.1
38	9720-2	0	0.3 7 1.1





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(2) Storm Sewor

		Analy se:	3 *	
	Uranium	Activity	Total Acid	ity-CaCO3
Sampla No.	ppm	/uc/ml	_ppm**	pH
56	0,018	2×10^{-8}	127	7.1.
57	<0.005	4×10^{-8}	117	7.6
58	0,007	2 x 10 ⁻⁶	37	7.1
59	0,008	$1. \times 10^{-8}$	113.	7.3
60	<0.005	1×10^{-8}	114	7,2
61	0.014	2 x 10 ⁻⁸	65	7.2
62	0.018	1 x 10 ⁻⁸	· 113	7.5
63	<0.005	2 x 10 ⁻⁸	120	7.7
64	0.018	1 x 10 ⁻⁸	117	7.8
65	0.007	2 x 10 ⁻⁸	115	7.7
6 <i>E</i>	∠0.005	9 x 10 ⁻⁹	143	7.8
67	0.008	5 x 10 ⁻⁸	11.5	7 - 4
68	0.008	5 x 10-8	109	7.2
6 5	0.005	4 x 10 ⁻⁸	109	7.3
70	0.008	2 x 10 ⁻⁸	138	7.3
	0.028	3 x 10 ⁻⁸	109	7.7
7].		1 x 10-8	109	7.9
72 72	0.006		89	7.2
73	0.006	2 x 10 ⁻⁶		
7 <i>6</i>	0.008	5 x 10 ⁻¹⁰	119	7.9

*Relative Error (Confidence Level, 95%): Uranium (ppm) = 100%; Acidity = 10% ***0.0 ppm = pH 7.0

(3) Sanitary Sewer

		ANALYSES	S*	
•	Uranium	/ctivity	Total Acid	ity-CaCO3
Sample No.	pum	/uc/ml	ppm**	pН
<u>4</u> €	<0.005	1 x 10 ⁻⁸	116	7.1
47	0,,008	1 x 10 ⁻⁸	189	6.6
48	0.018	4 x 10 ⁻⁹	147	7
49	0.008	2 x 10 ⁻⁸	159	6.9
50	< 0,005	1×10^{-8}	490	8
51	0,006	2 x 10 ⁻⁸	162	6.3
52	<0,005	2 x 10 ⁻⁹	112	7.1
E 3	0.018	2 x 10 ⁻⁸	153	6.6
54	0,008	1 x 10 ⁻⁸	125	7
55	0,008	4×10^{-8}	145	7 . 3
56	0.005	3×10^{-8}	187	7.2
57	<0.005	3×10^{-8}	102	7.3
56	0.028	2×10^{-8}	146	6.8
59	0.007	2×10^{-8}	163	7.2
60	0.018	5×10^{-8}	150	6.7
61.	0.028	6×10^{-8}	160	6 - 9
62	< 0.005	3 x 10 ⁻⁸	99	7.3
63 63	0,008	2×10^{-8}	149	7.2
64	0,008	3 x 10 ⁻⁸	192	7.3

*Relative Error (Confidence Level, 95%): Uranium (ppm) = 100%; Acidity = 10% **0.0 ppm = pH 7.0



C. Site Surveys

(1) Durmy Loads in Buildings 9731 and 9204-3

An investigation of these instruments indicated that the level of x-rays coming from the sides and top is several times tolerance allowed for continuous eight hour exposure. A procedure has been set up so that each person operating the dummy load will wear an x-ray film badge.

(2) Buildings 9201-2, 9201-3 and 9211

These buildings have been surveyed and results are being tabulated.

(3) Building 9202

The building survey has not been completed as yet. Rooms are being readied for occupancy by the Shielding Group of Oak Ridge National Laboratory. Advice is given as to amount of decontamination needed and as soon as cleaning is completed, rooms are checked.

(4) Scrap Material

The survey of scrap material in 88-21 has been completed and it has been determined what material is to be hauled to X-10 for burial. The survey of the materials in Midway warehouses is proceeding but not enough is yet known to begin actual removal.

(5) Radiography Shack -- 9212

Shielding material has been installed in the Radiography Shack at 9212 amounting to one-fourth (4) inch lead, seven (7) feet high and twelve (12) inches of concrete eight (8) feet high. The radiation at the fence is calculated as 1.25 mr/hr.

D. Shipment Surveys

Cne hundred and ninty-two (192) lots of shipments were checked for Alpha, Beta and/or Gamma activity in accordance with Standard Practice Procedure #20-A for release of property for shipment from the Y-12 Area.

II. SPECIAL STUDIES

A. Urinary Uranium for Determining Degree of Exposure

A study has been started correlating urinary uranium and air-borne contamination. Efficiency and accuracy of present methods are also being checked.

B. Air Sampling Wethods

The study of air sampling methods is being continued. The present stage is the letermination of efficiencies of parallel-plate ionization chambers used for counting dust samples. At present three counters are being used for counting these samples. An effort is also being made to reduce background counts.





III. PERSONNEL CNITCRING

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A. Alpha land Counts

Hand Count Totals, October 1 - 31, 1948

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Dept,	Total Left Hand Counts	Total Right Hand Counts	Total Left Hand Above-tolerance Counts	Total Right Hand Above-tolerance Counts
				_
Al2V	1.5	15	8	5
/14N	107	107	6	9
Al6N	291	291	238	240
A17N	52	52	29	31
AZON	239	269	2	3
B12C	1991	1991	151	158
B12H	2652	2652	371	371
Bl2L	1236	1286	203	207
H12D	439	489	32	33
1/12P	2639	2689	383	345
M13P	1100	1100	231	272
Totals	10,941	10,941	1,654	1,674

B. Beta, Jamma Hand & Foot Counts

Totals, November 1-30, 1948

		Bldg. 9206	Bldg. 9212, C-1
Total	Left Hand Counts	1880	188
	Right Hand Counts	1872	188
Total	Foot Counts	942	98
Total	Left Hand Above-tolerance Counts	1	18
Total	Right Hand Above-tolerance Counts	0	27
Total	Foot Above-tolerance Counts	14	24

C. Personnel Meters

A total of one hundred and fifty-one (151) film badges worn by personnel in the Assay Laboratories. Radiography Shop, Spectrograph Laboratory and "Metal" Machine Shops were processed during the period. The total number of pen chamber readings recorded was 826,

Part III - Industrial Hygiene

I. AIR SURVEYS

A. Trichlorethylene (M.A.C. - 200 ppm)

(1) Rooms 17 and 19. Blage 9206

Location	UNCLASSIFIE	Concentration (ppm)
Room 17		
Breathing Level at	Conveyor	1300
Breathing Level at	Conveyor	1300



UNCLASSIFIED



(easured Concentration (ppm)

Room 19

Location

Ereathing Level, Center of Room

800

The use of trichlorethylene was discontinued early in the month. Perc.:lorethylene is now used.

B. Perchlorethylene (M.A.C. - 200 ppm)

(1) Rooms 17 and 19, 9206

Nineteen (19) samples taken gave the following concentrations:

Neasured

Location	Concentration (ppm)
Room 17	
Breathing Level at washer	49
Preathing Level at Second Wash	56
Breatning Level at Second Wash	32
Breathing Level at Dryer	14
General Breathing Level	15
Coneral Broathing Lovel	32
General Breathing Level	29
Breathing Level at Centrifuge	14
Breathing Level at Centrifuge	4 6
Breathing Level at Centrifuge	27
Breathing Level at Centrifuge	37
Ereathing Level at Centrifuge	22
Breathing Level at Centrifuge	34
Breathing Level at Press	18
Breathing Level at Conveyor Pit	40
Breathing Level at Condenser	49
Room 19	
Breatning Level at Open Pan	107
In Doorway Between Rooms 17-19	18
In Doorway Between Rooms 17-19	21

C. Nitrogen Dioxide (M.A.C. - 25 ppm)

(1) Fifteen (15) samples were taken with concentrations as follows:

Location		leasured Concentration (ppm)
Bldg. 9206		
Room 22 22 25 25 26 26 34	1 To Language Land	3 3 1 1 1
	The second second	



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Location		Measured Concentration (ppm)
allege supposed the second sec		
Bldg. 9206		
		1.0
Room 34		1.8
34		1.5
36		1
38		5
39		1.5
63		1
		i
63		*
Bldg. 9709		
Electric Welding	Shon	5

Electric Welding Shop

Benzene (M.A.C. - 100 ppm)

(1) Bldg. 9737

Three (3) samples were taken with concentrations as follows:

Location					Concentration (ppm)
Br eathing	Level	at	Dip	TankClosed TankClosed TankClosed	0 · 430 90

Ammonia (M.A.C. - 100 ppm)

(1) Blage 9206

Two samples were collected with the following results:

Location	Concentration (ppm)
Rcom 21	95
Rcom 22	9 3

(2) Bldg. 9212

Two samples were collected with the following results:

Location	Goncentration (ppm)
Rcom 46-B	127
Rcom 46-A	• 71

F. Hood Checks

One (1) hood check was made in Building 9206, Rocm 110, in conjunction with Project 24. No reduction in vantilating efficiency was determinable, as by loading up of the filters.



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11. STUDIES

- A. Preliminary experiments were made, relative to various methods for decontemination of fire extinguishers.
- B. Library research, relative to the symptoms of poisoning from barium oxide, was cursorily made.
- C. A literature survey was also made relative to the toxicity of thorium.
- D. Finally, determinative study was made toward contemplated establishment of a procedure for faecal uranium analysis.

III. URIWAWALYSIS

A. Summary of Analyses

Total number of analyses (including duplicates)	170
Number of cases showing presence of uranium	12
Number of cases showing moderate exposure	2
Number of Fluorimetric determinations	49
Number of Alpha count determinations	121

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Y-12 CENTRAL FILES

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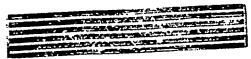
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HEALTH FHYSICS - INDUSTRIAL HYGIENE PROGRESS REPORT

October 1 - 31: 1948

CLASSIFICATION CHANGED TO UNCLASSIFIED
BY AUTHORITY OF TID-1154
BY M Park DATE 9/4/57

E. G. Struxness

Oak Ridge, Tennossee
November 10, 1948

Index No. Y-280/R

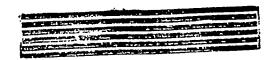
Distribution, Series A:

Mr. S. R. Sapirie, ORO Mr. C. E. Center 5. Dr. C. E. Larson 6. 7. Mr. W. D. Lavers Mr. E. C. Cain Dr. P. D. Scofield 8。 9, Dr. A. Kammer 10. Dr. E. D. Shipley 11. 12. Mr. E. G. Struxness Mr. John Morfitt 14.-15. C. R. I. O.

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HEALTH PHYSICS--INDUSTRIAL HYGIENE PROGRESS REPORT October 1 - 31, 1948

Part I - Introduction

I. GENERAL

During the latter half of the period a major effort was made in beginning the survey of several presently unused buildings for radioactive contamination. Since these buildings are quite large and the survey quite extensive, this effort must necessarily be made at the expense of the rest of the program in view of our limited personnel and equipment. However, the services of three additional persons on loan from Department B12H for a period of two to three months beginning with the next period, should effect some improvement in this regard. It is expected that the survey will be completed within the next two periods.

Part II - Health Physics

I, ROUTINE SURVEYS

A. Air Surveys

One hundred and thirty-four (134) samples of air-borne uranium were taken in thirteen (13) different work locations in accordance with the schedule previously reported. See Report #Y-138 dated 3-9-48. Approximately 57% of these samples gave concentrations in excess of the accepted N.A.C. of 150 Mg/M³ while 43% showed concentrations exceeding the established radiation tolerance level of 1225 d/M³/minute in the following locations.

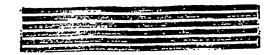
(1) Building 9206

Fifty-four (54) above tolerance concentrations were obtained during the following operations:

- (a) Room 6 Over oven tray while vacuuming ash from uranium metal.

 Around exhaust of Filter Queen while vacuuming
- (b) Room 17 Over chip tray beside press.
 - Dumping chips into tray beside press.
 - Over hopper of crusher,
 - Beside press while pressing brickettes.
- (c) Room 41 Dumping and burning uranium floor sweepings.
 - General room concentration.
 - Burning of uranium chips.
 - Vacuuming out carbon crucibles.
 - Around exhaust of Filter Queen while vacuuming carbon crucibles.





(d) Room 51 - Loading V. P. Reactor Bowls. - General room concentration.

(2) Building 9212

Twenty (20) above tolerance concentrations were obtained during the following operations:

- (a) Furnace Room, C-1 Breaking carbon from metal casting.
 - Removing top lid & brick from #1 furnace.
 - Removing carbon crucible from #1 furnace.
 - Removing bottom lid & casting from #1 furnace.
 - General room concentration.
 - Removing bricks from #2 furnace,
 - Removing carbon crucible from #2 furnace.
 - Removing bottom lid & casting from #2 furnace.
 - Dipping metal casting into drum of water.
 - Sanding inside of carbon crucible.
- (b) Machine Shop, C-1 General room concentration.

(3) Building 9204-3

Ten (10) above tolerance concentrations were obtained during the following operations:

- (a) Chemical Recovery Washing liner unit.
 - Disassembling 'A unit.
 - General room concentration.
- (b) Chemical Process Drying filter cake with air pressure.
 Drawing off 1300 batch from filter press
 - into dollie.

(4) Building 9201-4

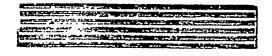
- One (1) above tolerance concentration was obtained during the following operation:
- (a) Mechanical Service Grinding re-run carbons.

(5) Building 9731

- One (1) above tolerance concentration was obtained during the following operation:
- (a) Chemical Recovery Disassembling M unit.

B. Kater Surveys

Potable water, storm sewer (East Fork Poplar Creek) and sanitary sewer samples are taken regularly at predetermined frequencies and locations. The analytical results are tabulated below:



Mars.

(1) Potable Water

Sample No.	Building	Uranium Conc. parts per billion	Alpha Counts per minute per 100 ml.
80	9737	0	0.1 + 1.1
81	9920-2	0	0 ₅ 1 → 1 _c 1
82	9206	0	0.2 7 1.1
83	971C-2	0	0.1 🗓 1.1

(2) Storm Sewer

Sample No.		ANALYS	ES.≄	
	Uranium	Activity	Total Act	idity-CaCO3
	ppm	_uc/ml	ppm**	рН
~ 4	40.00 5	1 x 10 ⁻⁸	2	
34	<0,005		5	
35	<0.005	1 x 10 ⁻⁶		
36	0.01	2 x 10 ⁻⁸	2	
37	0.005	1 x 10 ⁻⁸	6	
38	0.006	2 x 10 ⁻⁸	1.5	
39	0-005	1×10^{-6}	4.5	
40	0.006	1 x 10 ⁻⁸	7	
41	0.0016	1 x 10 ⁻⁸	8.5	6-8
42	0.024	1 x 10 ⁻⁸	6	8 28
43	005 د02	1 x 10 ⁻⁸	4.0	7.1
44	<0,005	1 x 10 ⁻⁶	3. 5	7.7
45	0,028	2×10^{-8}	5	7.,1
46	0.006	4 x 10 ⁻⁶	0	10.6
47	0.017	4 x 10 ⁻⁸	16	7
48	< 0 - 005	3 x 10 ⁻⁸	20	69
49	0.005	2 x 10 ⁻⁸	5	7,5
50	0.014	2 x 10 ⁻⁹	8	7.4
51	0,024	2×10^{-8}	1.5	7.9
52	0.010	1 x 10 ⁻⁸	0	7 ₌ 7
54	0.058	3×10^{-8}	131	7.3
55	40,005	1 x 10 ⁻⁸	113	7.3

*Relative Error (Confidence Level, 95%): Uranium (ppm) = 100%; Acidity = 10% **0.0 ppm = pH 7.0

(3) Sanitary Sewer

		ANALYS	ES*		
Sample No.	Uranium	Activity		Total Acidity-CaCO3	
	ppm	uc/ml		pН	
24	0.01	1×10^{-8}	27		
25	0,04	1×10^{-8}	3		
26	0,007	1 x 10 ⁻⁶	12		
27	<0,005	1×10^{-9}	2.5		
28	0,02	2×10^{-6}	12.5	•	
2 9	0.02	2×10^{-5}	5.5		
30	0,010	2 x 10 ⁻⁸	6		
31	0:006	1×10^{-8}	23	6.4	
32	0.011	1 x 10 ⁻⁸	5 3	3.2	
33	0.023	1 x 10 ⁻⁶	5 5	6 - 8	
34	<0.005	1 x 10 ⁻⁸	35	6.,9	



		ANALYS	2S.*		
Sample No-	Uranium	Activity	Total Aci	Total Acidity-CaCO3	
	ppm	· uc/ml	_ppm**	рН	
35	0.018	1 × 10 ⁻⁸	22	7.1	
36	∠0.005	14×10^{-8}	30	6.9	
37	0.048	1×10^{-8}	25	5.1	
38	0.033	4 x 10 ⁻⁵	15	7.2	
39	0.019	6×10^{-8}	15	7.2	
40	<0.005	7×10^{-8}	22	6.8	
41	∠0.005	2 x 10 ⁻⁸	5	7.4	
42	0.030	2 x 10 ⁻⁸	2	7.6	
43	0.028	1 x 10 ⁻⁸	15	6.8	
44	800 و 0	2×10^{-8}	305	6.8	
45	< 0.005	1 x 10 ⁻⁸	164	6.8	

*Relative Error (Confidence Level, 95%): Uranium (ppm) = 100%; Acidity = 10% **0.0 ppm = pH 7.0

C. Site Surveys

(1) Midway Salvage Material

It was requested of the General Plant Maintenance Department by the AEC that these approximately 80 barrells of unidentified salvage material be moved from their present outside location into one of the warehouses in the Midway Area. Upon checking the barrells for radioactive contamination in order to predict the precautions to be taken in handling, the level of activity present seemed high enough to warrant a thorough analysis. Listed below is the analysis of one composited sample. Instructions have been provided for safe handling but they have not been moved as yet.

Sample No.	Mg/gm- Uranium Pe	
45	10.2	5

(2) Roon 17, Bldg. 9206

The "chip" drying tray adjacent to the press has been, and continues to be, the most consistent source of excessive air-borne uranium concentrations. Nork orders and engineering drawings are almost completed for the additional ventilation facilities which should bring about some improvement. Meanwhile, the operators working in the area are required to wear respirators.

(3) Bldg. 9211

The survey of this building has been completed and the results are being compiled. The survey includes both wipe test and direct reading measurements.





(4) Room 17, Bldg: 9202

In the preparation of this room for use by the Shielding Group of Oak Ridge National Laboratories, surveys were made of surfaces and floors which indicated the need for extensive decontamination. Up to 20 Mrep/hr of beta and gamma activity was found to exist at the floor surface with only slight degrees of contamination detectable on walls and ceilings. After vacuum cleaning and washing of the floors and walls with a strong solution of soda ash, it was found necessary to remove and replace an approximate two inch layer of the concrete in several floor spots where spills were obvious. All equipment and plumbing fixtures at floor level were removed and one coat of lead pigment paint was applied to wall and ceiling surfaces. Although some low level activity is still present, it is well within safe limits and acceptable to the ORNL group.

(5) Rooms 17 and 41, Bldg. 9206; C Wing and Room 45D, Bldg. 9212. (See IA (1) & (2) above)

The operations carried on in these locations have consistently given high air-borne uranium concentrations during the last three month period. While attempts have been made to alter procedures and effect improvements; they have met with little or no success.

The entire problem is now being studied by the Plant Engineering Department and the Chemical Division in an effort to modify existing equipment and ventilation facilities, if possible, to the point where respiratory protective devices need not be worn by personnel working in these areas.

D. Shipment Surveys

Two hundred and twelve (212) lots of shipments were checked for Alpha, Beta and/or Gamma activity in accordance with Standard Practice Procedure #20-A for release of property for shipment from the Y-12 Area.

II. SPLCIAL STUDIES

A. Urinary Uranium for Determining Degree of Exposure

In the case of uranium and other radio elements which enter the body through inhalation, ingestion, skin punctures, etc., the dose, or amount deposited in the tissues, cannot always be foretold from the degree of exposure as determined by monitoring the air, table tops, hands, clothing, etc. The degree of exposure can be used as a guide, however, to indicate the possible degree of desage that may result.

Since there is not a large experience of long-period chronic exposure at this site upon which to formulate a forthright program of adequate personnel protection, a study of urinary uranium correlated with associated monitoring data might serve to remove a great deal of the uncertainty which exists at the present time with respect to degrees of exposure. That is to say, a program of Industrial Health Rechecks for personnel on a given job would be based on predetermined exposure findings in terms of monitoring data and urine uranium concentrations rather than exclusive





reliance on amounts monitored in the air, on the hands, etc. With this purpose in mind, a survey of buildings, areas and/or rooms together with excretion tests of personnel in these work locations is being carried out in this manner:

- (1) The plant is classified into specific and typical work locations on the basis of air, surface, clothing, and hand monitoring data already known.
- (2) Three subjects within the typical location are chosen at random and given complete instructions as to the purpose of the study; the vigorous conditions necessary to prevent contamination of the specimen, etc.
- (3) The subjects are directed (and aided) to collect all specimens of urine voided during the three day duration of the test. All sample collecting is done at home or at the dispensary.
- (4) For the duration of the test, the subjects' work location is monitored extensively for air, surface, clothing and hand contamination.
- (5) Aliquots of the 24 hour urine samples are analyzed fluorophotometrically (normal U exposure) or by the alpha count method (enriched U exposure) for uranium content.

The results to date are summerized below:

Location: Room 51, Bldg. 9206

Number of Subjects: Two

Duration of Test: Three days

Operation: Converting natural uranium oxide to uranium tetrachloride

Monitoring Data:

	Highest	Mean	Lowest
	Measurement	Measurement	Measurement
Air (µg/M ³) Surface Wipes (c/min.) Clothing (c/min.)	15007.6	1339 ₋ 4	20.1
	3547.0	846.7	82.0
	1100.0	171 ₋ 3	20.0
Hands (o/min.)	500.0	68 . 0	20.0

Urine Findings: Average amount of uranium excreted per 24 hours-3.65 Aug

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(2) (2) (2) (2) (2) (2)



Location: Room 17, Bldg. 9206

Number of Subjects: Three

Duration of Test: Three days

Operation: Natural uranium "chip" recovery

Monitoring Data:

	Highest Measurement	Measurement	Lowest Measurement
Air (Mg/M ³) Surface Nipes (c/min.)	80,229.8	14,784.9	27.2
Clothing (c/min.) Hands (c/min.)	10,000.0	1,072.0 79.0	30.0 20.0

Urine Findings: Average amount of uranium excreted per 24 hours-8.86 ug

B. Air Sampling Methods

Some progress has been made on a study of the relative efficiencies of three alpha air monitoring methods, viz., Filter Queen, Tornado (K-25) and Electrostatic Precipitator. A parallel plate ionization chamber has been constructed to facilitate counting of the 9 mm filter paper used in the Tornado and calibrations of the rate of flow have been completed.

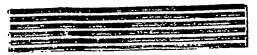
III. PERSONNEL MONITORING

A, Alpha Hand Counts

Eand Count Totals, September 1-30, 1948

Dopt:	Total Left Hand Courts	Total Right Hand Counts	Total Left Hand Above-tolerance Count:	Total Right Hand Above-tolerance Counts
A12V.	14	14	5	6
Al4N	93	93	8	11
A16N	614	614	487	499
Al7N	364	364	42	53
B12C	2554	2554	257	303
B12H	3294	3294	695	640
Bl2L	1561	1561	427	426
H1.2D	333	333	20	22
H12L	75	75	7	6
M12P	3278	327 8	490 ·	491
M13P	1217	1217	359	422
Totals	13,397	13,397	2,797	2,879





B. Beta, Gamma Hand & Foot Counts (Bldg. 9206)

Totals, October 1-31, 1948

Total	Left Hand Counts	3274
Total	Right Hand Counts	3274
	Foot Counts	1638
Total	Left Hand Above-tolerance Counts	10
Total	Right Hand Above-tolerance Counts	13
Total	Foot Above-tolerance Counts	136

C. Personnel Meters

A total of one hundred and ninty (190) film badges worn by personnel in the Assay Laboratories, Radiography Shop, Spectrograph Laboratory and "Metal" Machine Shops were processed during the period. The total number of pen chamber readings recorded was 1030.

Part III - Industrial Hygiene

I. AIR SURVEYS

A. Trichloroethylene (M.A.C. - 200 ppm)

(1) Room 17, Bldg. 9206

Twelve (12) samples taken in the "chip" cleaning area gave the following concentrations:

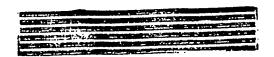
Location		Measured Concentration (ppm)
General Air Concentration Breathing Level at Storage	Tank	2 6834
Breathing Level at Storage	fank	399
Breathing Level at Storage Breathing Level at Storage		323 239
Breathing Level at Storage	Tank	324
Breathing Level at Storage Breathing Level at Storage		6468 593
Breathing Level at Dryer Breathing Level at Dryer		44 7
Breathing Level at Crusher		3905
Breathing Level at Crusher	•	162

The department has since changed the cleaning solution to Tetrachloroethylene and the condition is noticeably improved. Respiratory protective equipment is mandatory and further study of air condition in this room is continuing.

(2) Low Voltage Shop, Bldg, 9737

Three (3) samples were taken in the degreasing area with the following results:





Location	Measured Concentration (ppm)
Breathing Level at Degreaser	0.8
Breathing Level at Degreaser	0.0
Breathing Level at Degreaser	47.0

B. Benzene (M.A.C. - 50 ppm)

(1) Low Voltage Shop, Bldg. 9737

Three (3) samples taken in the varnishing area indicate the need for further sampling.

Location	Measured Concentration (ppm)	
General Air Concentration	0.0	
Breathing Level at Dip Tank	20.0	
Breathing Level at Dip Tank	110.0	

C. Barium Oxide (M.A.C. as Ba - 0.5 Mg/M^3)

(1) Chemical Process Area, Bldg. 9204-3

Three (3) samples were taken during the spraying of a liner with a colloidal slurry of BaO in ethyl alcohol. The operator is required to wear a respirator.

Location	Measured Concentration (Mg/M ³)
General Air Concentration	0.0
Breathing Level While Spraying	11.0
Breathing Level While Spraying	66.0

II. URINANALYSIS

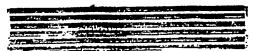
A. Procedure Development

In the preparation of urine concentrate for the analysis by the count method, a xylene partition step has been added to the extraction procedure. Ferric nitrate solution has also been added to the saturated solution of ammonium nitrate to act as a carrier. It is hoped that these changes will improve the sensitivity of the method by lowering the limits of detection.

B. Summary of Analyses

Total number of analyses (including duplicates)	124
Number of 24 hour semples	60
Number of cases showing presence of uranium	43
Number of cases believed to be grossly contaminated	0
Number of Fluorimetric determinations	60
Number of Alpha count determinations	64





Part IV - Miscellaneous Staff Activities

I. REPORTS ADDED TO HP-H FILES

Morgan, K. Z.; "Health Physics and Its Control of Radiation Exposures at Clinton Lab."; MDDC-937.

Murray, Raymond; "Radiation Hazards from Polonium, Initial Survey"; A-7.390.30.

Dowdy, Andrew H.; "Quarterly Technical Report"; 7-1-47 to 9-30-47, University of Rochester; M-2002.

Bale, W. F.; Monthly Progress Report for May, 1947, University of Rochester; M-1973.

Bell, P. R.; "Pocket Radiation Alarm"; Clinton National Lab. MDDC-1180. "Beryllium Symposium"; University of Rochester; AECD-1803.

"Beryllium Symposium"; University of Mochester; AECD-1003.
Cantrell, Mikson; "Uranium Poisoning"; Argonne National Lab.; MDDC-1199.
Cantril, Parker; "The Tolerance Dose"; Argonne National Lab.; MDDC-1100.
"Handbook of Radioactivity and Tracer Methodology"; U. S. Air Force; Np-233.
Vol. I, No. 7, October 15, 1948, Nuclear Science Abstracts, AEC, Oak Ridge, Tenn.

II. MEMORANDA ISSUED

Author	Subject	Recipient
Struxness, E. G.	"Library Authorization for E. C. Long"	Uffelman, Jane
Long, E. C. Struxness, E. G.	"Code on Urine Sampling Boxes" 10-14-48 "Cooperative Project-Health Hazards" 10-18-48	Watson, N. O. Bradley, J. E.
Struxness, E. G.	"Uranium Determination in Urine" 10-28-48	Keim, C. P.

E. G. Struxness



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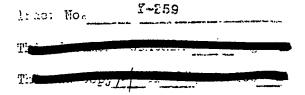
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CARBIDE AND CARBON CHEMICALS CORPORATION

Y-12 PLANT

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HEALTH PHYSICS - INDUSTRIAL HYGIENE PROGRESS REPORT

September 1 - 30, 1948

GLASSIFICATION CHANGED TO Anchassifued

BY MOMENTA DATE 3/24/22

E. G. Struxness

Oak Ridgo, Tonnessee October 8, 1943



Index No. Y-259

Distribution, Series A:

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- Mr. C. E. Center 5.
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- 10. Dr. A. Kemmer
- Dr. E. D. Shipley 11.
- Mr. E. G. Struxness 12.
- Mr. John Morfitt 13,
- 14-15. C. R. I. O.

Central Reports and Information Office

Date Issued:



HEALTH PHYSICS.-INDUSTRIAL HYGIENE PROGRESS REPORT September 1 - 30, 1948

Part I - Introduction

I. GENERAL

A significant development during this period has been the establishment of an Industrial Hygiene Laboratory within the existing Analytical Services of the Chemical Development Department. Through the cooperation of Messrs. G. H. Clewett and C. D. Susano, arrangements have been completed, and facilities and personnel have been assigned for this project. It is planned that "P-H personnel and the Industrial Hygienist will take the responsibility for determining sampling frequency, sampling location, and the actual taking of samples while the laboratory group will perform the analytical functions attendant thereto. The two groups are cooperating fully in establishing analytical procedures and sampling techniques.

Efforts are continuing to secure and/or develop improved survey equipment. Modifications of the Walkie Poppy and Walkie Squawkie are being tested and show some promise. A device for collecting continuous 24 hour samples of the storm and sanitary sewer effluents has been built and will be put into operation shortly.

The uranium urinaualysis program is now started with present equipment and personnel limiting the number of daily analyses to about ten.

II. ORGANIZATION AND PERSONNEL

Edward C. Long was welcomed into the department during the month. Mr. Long, who comes to us from the University of Georgia, was an Assistant Professor of Physics at the university, having taught there for the past six years save for a brief period during the war at which time he was employed by Tennessee Eastman Corporation at this plant. He obtained his Master of Science degree with a major in Physics in June of this year.

Part II - Health Physics

I. ROUTINE SURVEYS

A. Air Surveys

One hundred and thirty-four (134) samples of air-borne uranium were taken in seventeen (17) different work locations in accordance with the schedule previously reported. See Report #Y-138 dated 3-9-48. Approximately 25% of these samples gave concentrations in excess of the accepted M.A.C. of 150 Mg/M³ while 26% showed concentrations exceeding the established radiation tolerance level of 1225 d/M³/minute in the following locations.

(1) Building 9206

Thirty-eight (38) above tolerance concentrations were obtained during the following operations:



- (a) Room 17 Over chip tray beside press.
 - Pressing brickettes.
 - Dumping chips into chip tray beside press.
 - Raking chips over screen.
- (b) Room 31 Removing white salt from furnace into dry box. - Around door of dry box.
- (c) Room 33 Solutioning, saturating and extracting uranium.
- Room 35 Scraping E pockets. (d)
- (e) Room 41 General room concentration. - Vacuuming out carbon crucibles.
 - Around exhaust of vacuum cleaner.
- Room 51 Loading V. P. reactors. (1)

(2) Building 9212

Twenty-three (23) above tolerance concentrations were obtained during the following operations:

- (a) Room 44-D = Over $\frac{\eta}{\pi}$ 3 dry box, filling reactor.
- (b) Room 45-D Removing filter paper from vacuum cleaner.
 - Removing skull from crucible.
 - Unloading static caster.
 - Cleaning carbon dust and solids from dry box.
 - Chipping carbon from casting.
 - Unloading hot press.
 - Placing carbon dust in salvage dollie.
- (c) Room 48-D Putting oxide into solution.
- (d) Room 59, C-1 Around top seal #1 dry box, weighing green salt.
 - Top lid off #1 dry box removing green salt.
 - Unloading reactor in #3 dry box.
 - Removing reactor from under #2 dry box.
 - Unloading reactor in #3 dry box.

(3) Building 9204-3

Five (5) above tolerance concentrations were obtained during the following operations:

- (a) Hechanical Service Area Grinding re-run carbons.
- (b) Major Repair Area Drilling inserts in H & J castings.

(4) Building 9201~4

ション、大東が開から、大台は、これの鉄道板、一条鉄道、もこうと、

(a) Track Room - Gleening tank in track.

B. Rater Surveys

Potable water, storm sewer (East Fork Poplar Creek) and sanitary sewer samples are taken regularly at predetermined frequencies and locations. The analytical results are tabulated below:

(1) Potable Water

Sample No.	Building	Uranium Conc. parts per billion	Alpha Counts per minute per 100 ml.
76	9203	0	0.0 + 1.1
77	9204-3	0	0.2 🗜 1.1
78	9733-4	. 0	0.3 🚡 1.1
79	9720-2	0	0.3 🔁 1.1

(2) Storm Sewer

		ANALYS	
Sampling Point	Uranium ppm	Activity Ac/ml	Total Acidity-CaCO3 ppm**
Drainage Channel (NW of Bldg. 9720-5) Drainage Channel (Midway at Scarboro	<0.005 <0.005	1 x 10 ⁻⁷ 1 x 10 ⁻⁷	
crossing) East Fork Poplar Creek at intersection of Oak Ridge Turnpike	<0.005	1 x 10-7	
Storm Sewer (SW of Blag. 9720-5)	£0.005	1 x 10-7	P
Drainage Channel (SW of Bldg. 9720-5)	0.008	1 x 10 ⁻⁸	
Drainage Channel (SE of Bldg. 9720-1)	0.008	3 x 10 ⁻⁸ 3 x 10 ⁻⁸	
Drainage Channel (500 ft. north of red light on Scarboro Road)	0.008	3 × 10	
Drainage Channel (SE of Bldg. 9204-3)	<0.005	1 x 10 ⁻⁸	
Drainage Channel (SW of Bldg. 972C-6)	1	2 x 10 ⁻⁸	13
Drainage Channel (Sm of Bldg. 9720-5)	<0.005	1 x 10 ⁻⁸	9

*Relative Error (Confidence Level, 95%): Uranium (ppm) = 100%; Acidity = 10% **0.0 ppm * pH 7.0

(3) Sanitary Sewer

		ANALYSES*		
		Uranium	Activity	Total Acidity-CaCO3
Sample No:	Sampling Point	ppm	Mc/ml	ppm**
No 9 15 16 17 18 19 20 21 22 23	NW Corner Bldg. 9723-4 SE of Bldg. 9206 West of Midway by new Patrol Rd. SE of Bldg. 9204-3 SE of Bldg. 9207 N of red light on Scarboro Rd. SE of Bldg. 9204-3 S of Bldg. 9207 SE of Bldg. 9207 SE of Bldg. 9208	<0.005 <0.005 0.01 <0.005 0.008 <0.005 0.02 0.007 0.009 <0.005	1 x 10-7 1 x 10-7 1 x 10-7 1 x 10-7 4 x 10-8 4 x 10-8 1 x 10-8 1 x 10-8 1 x 10-8 1 x 10-8	40 20 64 44 13 · 12 0.0 23 16

*Relative Error (Confidence Level, 95%): Uranium (ppm) = 100%; Acidity = 10% **0.0 ppm = pH 7.0



(4) East Fork Poplar Greek Sludge

		ANAI	LYSES#
Sample No:	Sampling Point	Uranium ppm	Activity uc/ml
1	Bear Creek at intersection of Poplar	0.09	3 x 10 ⁻⁷
2	Creek 100 feet upstream on up hillside of	0.03	2 x 10 ⁻⁷
3	Clinch River from Pumphouse Midway drainage channel at Scarboro	0.08	2 x 10 ⁻⁷
4 ·	crossing Last fork Poplar Greek and intersection of Oak Ridge Turnpike	0.07	2 x 10 ⁻⁷

(5) Sanitary Sewage Sludge (from Nest Village Sewage Disposal Plant)

		ANAL	SES*
Sample No.	Type Sample	Uranium ppm	% H ₂ O
205 206 207 208 209 210 211	**Blank Predigested Sludge Drying Bed Sludge Dried Sludge (from dump)	0.82 9.8 35.2 31.5 26.5 28.3 63.2	31.0 97.9 79.5 60.0 62.4 56.6 48.5

*Relative Error (Confidence Level, 95%) : Uranium (ppm) = 100% **The "blank" sample was taken at the disposal plant in Norris, Tennessee.

Refer to the last period report for preliminary information and findings regarding this investigation. It will be of interest to note the marked difference in uranium concentration of the predigested sludge in contrast with the other sample types. There is an apparent difference in concentration in the liquid and solid fractions of the sludge. On the basis of this limited data, the concentrations can be calculated to be 7.2 ppm and 130.0 ppm, respectively and good correlation is obtained in all analytical results. It is certainly safe to say that the solid sludge contains uranium to the extent of 100 ppm. These findings cannot be reconciled with present day concentrations of Y-12 sanitary sower effluents. Further investigation is proceeding and the AEC office of Oak Ridge Directed Operations is being advised of developments as they occur.

C. Site Surveys

(1) X-Ray Spectrograph in Bldg. 9731

An investigation of this machine by direct and indirect (Eastman Type K Film) measurements led to the discovery that the shielding



was inadequate at the front and back of the spectrograph, around the "dog house" window, and around the "dog house" door frame. Direct measurements of the order of 550 mr/hr were obtained at the spectrograph wall adjacent to the slit assembly. One quarter inch lead shielding was installed wherever the leaks were found to exist and this proved to be adequate. However, at the "dog house" window a softer radiation than high energy x-rays appears to be the cause of film blackening. It is thought that this may be due to secondary radiation coming off of the glass itself. The Special Hazards Group has been asked to make a study of this problem.

(2) X-Ray Spectrograph in Bldg. 9766

As in the case of the larger spectrograph mentioned above, x-ray leakage and scattering was positively identified and located by means of film and instrument measurement in and around this machine. Recommendations for improvement of shielding were submitted and operating personnel are wearing personnel monitoring meters.

(3) Room 17, Bldg. 9206

The improvement noted in this area as reported last month proved to be a temporary one and so efforts are continuing in the direction of further improvement. A hood is now being installed over the "chip" drying tray.

(4) Room 11, Bldg. 9203

A slight UF₆ explosion occurred in this room on the afternoon of September 17 in which two (2) employees were subjected to an unknown exposure. Subsequent surface checks revealed only a low order of contamination present and medical examinations of the two employees gave no indications of over-exposure. Twenty-four hour urine samples were obtained, the analyses of which showed uranium concentrations of 0.0041 µgm/ml + 0.011 and 0.0018 µgm/ml + 0.011.

D. Shipment Surveys

Two hundred and fifty-eight (258) lots of equipment were checked for alpha, beta and/or gamma activity in accordance with Standard Practice Procedure #20-A for release of property for shipment from the Y-12 Area.

II. SPECIAL SURVEYS

A. Company Issued Clothing

The following table is a summary of clothing measurements taken during the month of September:



Dept. No.	Uniforms	Shi	rts	1	users
•	Checkea	Contaminated	Not Contaminated	Contaminated	Not Contaminated
4100	19	0	19	o	19
A12S A13N	16	2	14	2	14
Alst	2	ō	2	0	2
A14N	4	ŏ	4	0	4
A15N	5	1	4	1	4 4
Al6N	22	1 0	22	1	21
Alon Alon	37	10	27	11	. 26
B12H (M)	23		19	7	16
B12H (F)	27	4 0	27	0	27
HIZE	15	4	11	4	11
Totals	170	21	149	26	144
Previous Totals	1108	206	902	266	842
Totals To Date	1278	227	1051	292	986

III. PERSONNEL MONITORING

A. Alpha Hand Counts

Hand Count Totals, August 1-August 31, 1948

Dept.	Total Left	Total Right Hand Counts	Total Left Hand Above-tolorance Counts	Total Right Hand Above-tolerance Counts
A14H A16N A17N B12C B12H B12L H12D M12P M13P	76 173 258 2061 2522 1213 96 2609 739	76 173 258 2061 2522 1213 96 2609 739	10 115 10 181 496 229 1 317 148	14 124 8 200 518 260 1 338 177
Totals	9747	9747	1507	1640

B. Bets, Germa Rand & Poot Counts (Eldg. 9208)*

Totals, Sept. 15 - Sept. 30, 1948

Total	Left fand Counts	780
Total	Right Hand Counts	780
	Foot Counts	390
Total	Left Hand Above-tclerence Counts	34
	Right Hand Above-tolerance Counts	32
	Foot Above-tolerance Counts	224

C. Forconnel Meters

A total of one hundred and thirty-five (135) film badges worn by personnel in the Assay Laboratories, Radiography Shop, Spectrograph Laboratory and "Metal" Machine Shops were processed during the period. Two over-exposures were obtained and referred to the Medical Department. The total number of pen chamber readings recorded was 931.

IV. LUSTRUEINTATION AND CALIBRATION

A. Calibration Shack

With monotonous regularity--"Mothing further can be reported." The apparent lack of progress can be attributed in a large measure to one factor in the present state of affairs, viz., Building 9212 modifications and appartenances.

E. Instruments on Order

Four (4) Survey Meters, Beta Gamma (SEC-7A).

C. Instruments Received

One (1) Beta, Gamma Hand and Foot Counter.

Two (2) Talkie Squawkies.

D. Auxiliary Equipment

Two campling devices have been completed for use in the sewer effluent investigation. Each consists of a 1/4 h.p. electric motor operating on all bronze, self-priming turbine type pump with priming chamber, strainers, foot valves, etc. The pump's capacity is 5 gpm against a total load of 15 feet.

*The five-fold hand and foot counter provides for simultaneous counting of heft Hand Palm, Left Hand Back, Both Feet, Right Hand Palm, and Right Hand Back. Tolerance levels are presently set at the following:

Hand-- 700 counts/min. ~1 mr/hr of B & 8 Shoc (Outside)-- 10,000 counts/min. ₹14 mr/hr of B & 8 Shoc (Inside)-- 1,000 counts/min. ₹0.33 mr/hr of B & 8





Part III - Industrial Hygiene

I. FIELD SURVEYS

Two (2) ventilation surveys were made in conjunction with Project 24 at Building 9206, Room #110. It was determined that a requisite minimum face velocity of 100 f.p.m. was being maintained at the two-sectional hood.

II. ESTABLISHMENT OF INDUSTRIAL HYGIENE LABORATORY FACILITIES

Arrangements have been completed for the establishment of laboratory facilities within Analytical Services of Department H12D. This laboratory will be concerned only with the analyses of samples and materials provided by the HP-H department. In this regard a visit was made by the Laboratory Supervisor. Mrs. M. Poore, and the Industrial Hygienist to the K-25 Industrial Hygiene Laboratory. Their procedures were reviewed and those which appear applicable may be used here at Y-120

III. URINANALYSIS

A. Precision of Urinanalysis Procedure

Statistical review of the special studies made has been completed and the following conclusion was reached. With twenty-five (25) ml samples the precision of single dish results at the level of 0.043 μgm/ml (43ppb) is twenty-six and six tenths (26.6) percent. Since fifty (50) ml samples are currently being used it is fair to assume that the same precision will be obtained for the analysis of samples having about one-half the concentration range studied (or about 22 ppb); and, since samples are currently being analyzed in duplicate, a somewhat better precision may be expected than for the single dish results.

B. Alpha Counts in Urine

Personnel working in certain areas are exposed to uranium of high specific activity in contrast to those who handle normal material. The chemical determination of uranium in urine by the fluorescence method being sensitive down to a concentration level of about 0.01 ugm/ml, it is felt that the alpha count method would be more reliable as a measure of exposure in those working with enriched uranium.

This procedure has been put to use during the past month and the analytical results are being studied with a view to determining its precision and accuracy. Nothing conclusive can be reported at this writing.





C. Summary of Analyses

Total number of urine analyses done in period	
including duplicates	58
Number of auplicates	29
	29
Number of 24 hour samples	11
Number of analysis showing presence of uranium	,
Number of cases believed to be grossly contemi	naceu o
Number of Fluorimetric Determinations	_
Number of alpha counts	52

Part IV - Miscellaneous Staff Activities

I. SEMINAR

The seminar is continuing as scheduled.

II. REPORTS ADDED TO EP-H FILLS

Johnson, D. J.; "Design of Air-Borne Alpha Emitter Sampler"; K-236.

"Medical and Health Divisions Quarterly Report," April, May and June, 1948,
University of California, Radiation Laboratory; UCRL 157.

Pardue, Goldstein, Rollan; "Photographic Film As A Pocket Radiation Dosimeter"; Argonne National Laboratory; MDDC-1065.

Parker, H. M.; "Radiation Hazards of Bremsstrahlung"; Clinton Laboratories; MDDC-1612.

Dessauer, Davis, White; "A Radiation Dose Integrator of High Sensitivity"; University of Rochester; AECD-1972.

III. MMOORANDA ISSUED

Author	Subject	Recipient
Struxness, E. G.	"Film ExposuresX-Ray Spectrograph"	Dr. C. P. Keim
Strumness, E. G.	"Calgonite Solution" 9-24-48	Dr. T. W. Nale

E. G. Struxness



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CARDIDE AND JARBON CHEMICALS CORPORATION

Y-12 PLANT

W-7405-Eng-26

HEALTH PHYSICS - INDUSTRIAL HYGIENE PROGRESS REPORT

August 1 - 31, 1948

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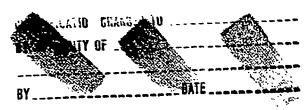
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2. G. Strumess





Our Ridge, Tennessee Deptember 9, 1948



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HEALTH FHYSICS--INDUSTRIAL HYGIENE PROGRESS REPORT August 1 - 31, 1948

Part I - Introduction

I. GENERAL

A major effort on the part of the Industrial Hygienist in cooperation with Messrs. E. W. Bailey and F. C. Uffelman of Product Material Control Department has been given to accurately determining the sensitivity factor, the precision and the accuracy of the urinary uranium procedure. Steps are also being taken to arrange the details associated with urine sampling frequency, departments to be investigated, sampling techniques, etc. It is expected that the routine analyses will be started during the next period.

The author attended the annual corporation Medical Conference at K-25 on August 18 - 20 and a conference on Waste Disposal at Oak Ridge National Laboratory on August 23 and August 24.

Significant visits to this plant during the period were made by Dr. T. W. Nale, Industrial Toxicology Department, Union Carbide and Carbon Corporation, New York, N. Y.; Dr. A. G. Kammer, C&CCC Medical Director, South Charleston, N. Virginia; Nr. J. Z. Holland, U. S. Weather Bureau Representative with AEC, Office of Oak Ridge Directed Operations; and Lt. Col. Wolfe, Naval Radiation Laboratory, Berkeley, California,

II. ORGANIZATION AND PERSONNEL

A. Personnel Transfer

Miss Gladys Dicus, Personnel Meters Technician, has transferred to the Analytical Department and the services of Miss Ruth H. Buttles have been secured in replacement. Miss Buttles is being trained in the operation of I.B.M. machines in anticipation of the need to provide such services for this department whenever the need arises.

B. Personnel Requirements

A personnel requisition has been submitted to the Personnel Department for the following:

One (1) Health Physicist

Part II - Health Physics

I. ROUTINE GURVEYS

· A. Air Surveys

Two hundred and twenty-four (224) samples of air-borne uranium were



taken in seventeen (17) different work locations in accordance with the schedule previously reported. See Report #Y-138 dated 3-9-48. Approximately 38% of these samples gave concentrations in excess of the accepted M.A.C. of 150 $\mu g/h^3$ while 48% showed concentrations exceeding the established radiation tolerance level of 1225 d/M³/minute in the following locations.

(1) <u>Building 9206</u>

Sixty-one (61) above tolerance concentrations were obtained during the following operations:

- (a) Room 6 Dumping contaminated ashes into hopper.
 - Shaking down contominated ashes into hopper.
 - General room concentration.
- (b) Room 17 Feeding chips into crusher.
 - Over lower end of conveyor.
 - . Unloading chips into tray by press.
 - Pressing chips into bricketts.
 - General Room Concentration.
 - Over upper end of conveyor.
 - Over chute at outlet end of conveyor.
- (c) Room 33 Ammonia precipitation of oxide.
 - Putting oxide into solution.
- (d) Room 41 Dumping of oxide.
 - General room concentration.
 - Vacuum cleaning carbon crucibles.
 - Around exhaust of vacuum cleaner.
 - Removing lid from carbon dust barrel.
- (e) Room 51 Loading of V.P. reactors.
 - Unloading of V.P. reactors.
 - General room concentration.

(2) Building 9212

Sixty-seven (67) above tolerance concentrations were obtained during the following operations:

- a) Room 44-D Over #2 dry box.
 - Removing reactor from under #2 dry box.
 - Over #1 dry box.
 - Securing reactor cover at vise.
 - Knocking out reactor over #3 dry box.
 - Loading reactor in #2 dry box.
- (b) Room 45-D
- Removing molded metal from hot press.
- Cleaning carbon insert with vacuum cleaner.
- Cleaning carbon from molded metal.
- Cleaning carbon dust from dry box.
- Putting carbon dust from metal into dollie.



- (b) Room 4E-D = Romoving casting from static caster.

 (Cont'c.) Removing casting from insert.
 - Removing crucible from static caster.
 - Removing skull from crucible.
 - General room concentration.
- (c) Room 48-D Putting oxide into solution.
- (d) Room 52-A Removing cover from rod mill.
- (e) Furnace Room, C-1 Wing Removing bottom plate from #1 furnace.
 - Breaking carbon from metal mold.
 - Loading metal into #1 furnace.
 - Dipping casting into drum of water.

B. Water Surveys

Potable water and storm sewer (East Fork Poplar Creek) samples are taken regularly at predetermined frequencies and locations. The analytical results are tabulated below:

(1) Fotable Water

Sample No.	Building	Uranium Conc. parts per billion	Alpha Counts per minute per 100 ml.
71	9735	0	0.3 + 1.1
72	9739	0	0.2 \$ 1.1
73	9710-1	0	0.5 후 1.1
74	9706-2	0	0.0 7 1.1
75	9712	0	0.0 🗓 1.1

(2) Storm Sewer

	Analyses:		
Sampling Point	Uranium ppm	Activity Ac/ml	
Drainage Channel (SW of Bldg. 9720-6) Drainage Channel (SW of Bldg. 9204-1) Clinch River (100 ft. upstream from Pump House) Bear Creek (at intersection of Poplar Creek) Bear Creek (at Oak Ridge Eurnpike bridge) Storm Sewer (No corner of Bldg. 9720-1) K-25 Sewage Disposal Outlet	<0.005 0.01 <0.005 <0.005 0.007 <0.005 <0.005	1 x 10 ⁻⁷ 1 x 10 ⁻⁸ 1 x 10 ⁻⁷ 1 x 10 ⁻⁷ 1 x 10 ⁻⁷ <1 x 10 ⁻⁸ 1 x 10 ⁻⁷	





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(3) Sanitary Sewer

		Analy	/ses*
Samplo No.	Sampling Point	Uranium ppm	Activity LC/ml
10	SE Corner Bldg. 9204-3	<0.005	1 x 10-7
11	SV: of Bldg. 9212	< 0 ≥ 005	1 x 10 ⁻⁷
12	SE of Bldge 9206	< 0.005	1 x 10°7
13	NE of Bldg. 9201-1	<0.005	1 x 10 ⁻⁷
14	S of Bldg. 9207	<0.005	1 x 10 ⁻⁷

*Relative Error (Confidence Level, 95%) : Uranium (ppm) = 50%

(4) Sanitary Sewage Sludge

Several sludge samples were collected at both the East Village and Rest Village Disposal Plants for purposes of analysis for uranium content. It was thought necessary to sample both plants since the East Village Plant was activated first in the early history of Oak Ridgo and accomodated the Y-12 Area before the present conditions were obtained when the West Village Plant was activated subsequently. These first samples were intended to provide a basis upon which to plan future investigations and. to develop analytical procedures. Surprisingly enough, the samples gave indications of containing uranium to the extent of from 17 to 100 ppm. It is now planned to pursue this investigation more carefully and to map the exact position of sampling locations since it has been the practice to dump the dried sludge indiscriminately over large areas. Blank sludge samples have now been obtained from the disposal plant at Morris, Tennessee. This investigation is being carried out with the approval and cooperation of the Atomic Energy Commission.

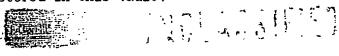
C. Site Surveys

(1) Room 17, Bldg. 9206

See Item (1) (b) (Air Surveys) on page 4. Two significant improvements in the Chip Recovery Cperation were installed in the latter part of the period, viz., an improved exhaust system and a redesigned crusher which permits enough coolant to be retained as to cause all cutting to be accomplished under complete submersion. Air sampling results following this improved installation show a marked decrease in air-borne concentrations.

(2) Chemical Storage Room, Bldg. 9766

As indicated in the previous report, all barrels and bottles containing uranium have been removed from this room to the large vault at the west end of the building where they will be adequately shielded and isolated. Hereafter, all similar materials will be stored in this vault.





(3) Salvage Earrels in Midway Storage Area

Because of increased construction activities, the riggers have not yet moved these barrels. However, Mr. C. B. Hopkins of the Construction and Maintenance Department has been given complete instructions as to the precautionary measures to be taken and it has been agreed that a HP-H representative will be present when the move is made.

(4) Room 110, Bldg. 9206

Preparatory to the chemical processing of enriched "W" in this laboratory, a survey was made of existing facilities with a view to providing maximum protection during the course of this project. It was recommended that the two hoods, in which all processing will take place, be exhausted through Type 6 Chemical Warfare Corps, filters and that a minimum face velocity of 100 feet per minute be maintained. The filters are being installed along with the booster fan required to maintain the minimum face velocity. Arrangements have also been made to confine and restrict the activities and movements of laboratory personnel during the course of the project in order to reduce the possibilities of contaminating other areas by tactile transmission. Provisions for hand counting and surface checking have been provided.

(5) Room 41, Bldg. 9205

See Item (1) (d), page 4. Consistently high air-borne concentrations during the dumping of oxide have indicated the need for improvement. Building supervision is now looking into the matter of improved methods and equipment in an effort to reduce the dust hazard.

D. Shipment Surveys.

Two hundred and fifty-one (251) lots of equipment were checked for alpha, bota and/or gamma activity in accordance with Standard Practice Procedure #20-A for release of property for shipment from the Y=12 Area.

II. SPECIAL SURVEYS

A. Company Issued Clothing

The following table is a summary of clothing measurements taken during the month of August:



Dept. No.	Uniforms	Sh:	Shirus		asers
oepos dos	Checked	Conteminated	Not Contaminated	Contominaced	Not Contaminated
rsla	3	0	\$	ı	2
A12S	20	0	. 20	0	20
Alsh	ì	0	1	0	1
Alsi	6	0	6	0	6
Alon Alon	35	13	22	14	21
A15N	17	0	17	0	17
Al7H	17		13	7	10
ALSM	2	4 0	2	0	2
Blen (M)	125	4.8	77	4.9	76
BLEE (F)	54	0	54	0	54
	3		2	0	3
H12E	1	1 3	7	3	7
HISL	1.0		•		
Tobals	293	69	224	74	215
Provious Tobals	815	157	678	192	623
T / PALS To Dato	1103	206	902	266	842

B. Million Volt X-Ray Installation

It is planted to install a million volt x-ray machine in a separate structure near Building 9212. The Engineering Department had done some work on General Layout and Preliminary Design when others were called upon for approval of the plans. A meeting of the Ungineering Group with representatives of ALC Safety, Engineering, Medicine and Research, and Y-12 Safety and Health Physics and Hygiene Departments concluded that the design did not meet with ASA standards nor with AEC requirements. Further study by members of the Special Hazards Group and a consultation between the present author and Mr. Mermagen of the University of Rochester led to the decision to improve the concrete shielding. Moreover, the .AMC Office of Medicine and Rosearch subsequently committed itself to reducing the daily tolerance (m.a.e.) from 0.1 r to 0.01 r which made it imperative that still more shielding would be necessary. final decision has, therefore, been made and approved to provide walls of 45 inch thick concrete to a height of 20.5 feet. The roof of the structure will be of gypsum bourd.

III PERSONNEL MONITORING

A. Mand Counts



Hand Count Totals, July 1--July 31, 1948

Dept.	Total Left Hand Counts	Total Right Land Counts	Total Left Hand Above-tolerance Counts	Total Right Hand Above-tolerance Coun
A14N A15N A16N A17N B12C B12H B12L H12D M12P M12P	54 28 54 300 2214 3281 1348 123 3303 893	54 26 54 300 2214 3281 1548 123 3303 893	6 28 26 25 368 738 343 9 286	6 28 24 25 358 738 375 7 279
Totels	11,598	11,598	2:085	2,108

B. Personnel Meters

A total of one hundred and thirty-five (135) film badges worn by personnel in the Assay Laboratories, Radiography Shop, Spectrograph Laboratory and "Metal" Machine Shops were processed during the period. Two over-exposures were obtained and referred to the Medical Department. The total number of pen chamber readings recorded was 1048.

C. Finger Impression Plates

Arrangements have been made with the Atomic Energy Commission to secure the analyses of finger print impressions on workers in the "Metal" Machine Shops and the Medical K-ray Technician. These impressions are made on Kerr lental plates and then microphotographed for analysis. A total of forty-three (43) sets of impressions were taken and sent to the AEC Office of Medicine and Research, Oak Ridge, for disposition in accordance with previous arrangements.

IV. INSTRUMENTATION AND CALIBRATICS

A. Calibration Shack

See the last period report. Nothing further can be reported at this writing.

B. Instruments on Order

Four (4) Survey Moters, Beta Gamma (SEC-7A), One (1) Survey Moter, Alpha, Beta, Gamma (SEC-3C).

C. Instruments Being Fabricated

One (1) Beta, Garra, Hand & Foot Counter (HEW Model). Two (2) "Walkie Squawkies."





Fart III - Industrial Hygiene

I. URINARY URAHIUM PROCEDURE

- A. The penta ether extraction and purification of concentrated samples was found to be a necessary part of the overall procedure.
- B. It was determined by means of statistical treatment of a fairly large number of special study results that the calibration (sensitivity) factor "F" of the Fluorimeter should be constant for a given batch of standard flux. A control chart has been developed that will permit a quick comparison of daily calibration checks to determine that each day's urine analyses are within the precision limits of the procedure.
- C. Statistical treatment also is being given to a large number of sample results, obtained in the course of a special study, to determine the precision of the overall procedure at the level of about fifty (50) parts per billion (0.050 /ugm/ml). The results of this study are almost complete.
- D. Another study has been made with a view toward determining the accuracy of the procedure. This incompleted study is based on "standard" solutions prepared in two different analytical laboratories. A difference of about seven percent (7%) has been found to exist, and it is planned to check this further.

It is felt that the procedure may now be put into use, subject for the time being to the accuracy limitation of seven percent (7%) as described above. Limits of precision will be established and reported at a later date.

II. OTHER INDUSTRIAL HYGIENE SERVICES

A. A field study was made relative to the proposed use of beryllium chloride in two (2) thallium runs and a memorandum was issued to supervision suggesting the precautionary measures to be taken.

Part IV - Miscellaneous Staff Activities

I, SEMINAR

The seminar is continuing as scheduled. Instrumentation and units of measurement are currently being studied.

II. BOOKS & REPORTS ADDED TO HP-H FILES

Jacobs, "Chemical Analysis," Vol. I., QD-139.
Pollard & Davidson, "Applied Nuclear Physics," QC-173.
"New York Medical College and Flower Hospital," Bulletin 5-6, 1942-43,
H610.5, N533, M5.





MEMORANDA ISSUED III.

Author

Struxness, E. G.

Struxness, E. G.

Struxness, E. G. Stephens, J. F.

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Subject

"X-Ray Spectrograph Leakage Check,"

"Hand Score Card Deficiencies," 8-10-48.

"Statement of Progress," 8-11-48. "Use of BeCl, in Thellium Runs, Building 9202-3," 8-27-48.

Recipient

Peed, W. F.

Herndon, J. Mo

McCormick, J. Ac Reece, J. S.



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CARBIDE AND CARBON CHEMICALS CORPORATION

Y-12 PLANT

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HEALTH PHYSICS - INDUSTRIAL HYGIENE PROGRESS REPORT

July 1 = 31, 1948

E. G. Struxness

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Oak Ridge, Tennessee August 6, 1948

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Index No. Y-215

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HEALTH PHYSICS--INDUSTRIAL HYGIENE PROGRESS REPORT July 1 - 31, 1948

Part I - Introduction

I. GENERAL

Significant progress can be reported on the matter of establishing facilities for routine urinalysis for uranium. This work will be done in the Dispensary Laboratory by a Medical Technician under supervision of this department. The department is indebted to Mr. Warren Grimes of the Research and Development Division and others for development of the fluorimetric procedure and initial training of the technician. It is thought that routine urine analyses will be started sometime within the next period.

Miss Horne, the Medical Technician, came into the Medical Department at the beginning of the period. At present, about 25 to 50 per cent of her time is being devoted to the bio-chemical analyses required by HP-H Department.

II. ORGANIZATION AND PERSONNEL

A. Industrial Hygienist

John F. Stephens

B. Personnel Meters Technician

Gladys G. Dicus

C. Radiation Inspectors (Surveyors)

Joe H. Hackney Richard W. Brothers Dean H. Reed

D. Instrument Repairment

J. Howard Campbell Virgil Lovett

E. Secretary

Jean Oliver

F. Medical Technician

Janet Horne

G. Personnel Requirements

A personnel requisition has been submitted to the Personnel Department for the following:

UNCLASSIFIED

Part II - Health Physics

I. ROUTINE SURVEYS

Air Surveys

One hundred and one (101) samples of air-borne uranium were taken in forty-three (43) different work locations in accordance with the schedule previously reported. See Report #Y-138 dated 3-9-48. Approximately 33% of these samples gave concentrations in excess of the accepted M.A.C. of 150 Mg/No while 25% showed concentrations exceeding the established radiation tolerance level of 1225 d/43/minute in the following locations.

(1) Building 9206

Twenty-two (22) above tolerance concentrations were obtained during the following operations:

- (a) Room 6 Dumping contaminated ashes into hopper. - Removing solids from muffled ashes.
 - Burning contaminated rags, paper, etc.
- (b) Room 17 Over crusher feed trough.
 - Over lower end of conveyor.
 - Over upper end of conveyor.
 - Over outlet chute into hopper.
 - Dumping chips from can into tray and sampling.
- (c) Room 31 Burning of salvage residue.
- Room 41 Dumping of oxide. - General room concentration
- (e) Room 51 Loading of V. P. Reactors.

(2) Building 9766

Two (2) above tolerance concentrations were obtained during the following operations:

- (a) Press Room Weighing of chips. - Pressing of chips into brickettes.
- (3) Building 9212

Nine (9) above tolerance concentrations were obtained during the following operations:

- (a) Room 45~D Loading reactor into hot press.
 - Removing skull from crucible:
 - Unloading crucible from static caster.
 - Removing mold from static caster.
 - Placing carbon dust in dollie.
 - Unloading hot presso
- (b) Room 46-D Loading carbon, rags and vacuum cleanings into UNGLASSIE



(c) Furnace Room - C-1 Wing - Removing seal at bottom of furnace and removing mold.

- Breaking carbon from metal mold.

B. Later Surveys

Potable water and storm sewer (Dear Creek) samples are taken regularly at predetermined frequencies and locations. The analytical results are tabulated below:

(1) Potable Water

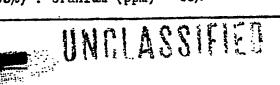
Sample No.	Building	Uranium Conc. parts per billion	Alpha Counts per minute per 100 ml.
67	9702-1A	0	0.6 + 0.6
68	9212	0	0.2 🛨 1.1
69	9720-6	0	0.2 + 1.1
70	9212	. o	0.2 + 1.1

(2) Storm Sewer

	Analy	808 †
Sampling Point	Uranium ppm	Activity .uc/ml
Drainage Channel (SW corner of Bldg. 9204-3.) Drainage Channel (SE corner of Bldg. 9401-2.)	0.01	1 x 10 ⁻⁷ 1 x 10 ⁻⁷
*Relative Error (Confidence Level, 95%)	: Uranium (ppm) = 50%

(3) Sanitary Sewer

Sample No.		Analyses*	
	Sampling Point	Uranium ppm	Activity .uc/ml
1	SE Building 9212	0.022	1 x 10 ⁻⁸
2	SE Building 9204-3	0.013	2 X 10-5
3	S Building 9206	0.01	$1 \times 10^{-7} \\ 1 \times 10^{-7}$
4	HE Building 9720-1	0.2	2 x 10 ⁻⁸
5	SE Building 9207	0.003	
6	SW Corner Building 9212	0.02	1×10^{-7}
7	SE Building 9204-3	0.01	1×10^{-7}
8	NV. Building 9204-1	0.01	1 x 10 ⁻⁷





C. Site Surveys

- (1) Emory Valley Salvage Yard. Preparatory to transferring steel and copper scrap from this location to the White Wing Bridge Yard, a survey of the scrap for alpha, beta and/or gamma activity was made. Survey findings indicated the need for handling this scrap with some precaution. It was recommended to the Planning and Estimating Department that the personnel detailed to do this job wear company issued clothing, safety shoes and leather gloves (the gloves to be replaced with new and unused ones each day) and to exercise care in keeping the hands clean prior to eating and smoking.
- Contaminated Equipment in Materials Laboratory of Bldg. 9766.

 A Micro-Pulverizer and Marshaw Testing Machine, havingbeen transferred to this area from ORNL, Biology Division, Building 9207, was checked and found to be grossly contaminated. Arrangements have been made with the Chemical Division to decontaminate this equipment before it is put to use in Building 9766.
- that the approximately 80 barrels of salvage material be moved from their present location into a warehouse. A cursory check of the material showed a fairly high level of radio-activity present so a composited sample was taken and sent to the Analytical Laboratory for analysis. Pending receipt of the analysis, recommendations will be submitted to the Planning and Estimating Department for safeguarding the personnel while executing this transfer.
- (4) Room 17 of Bldg. 9206. During preliminary operation and testing of the new chip recovery process, it was found that the exhaust system was inadequate. Chemical Division has since redesigned the ducts and they are now in the process of being installed.
- (5) Chemical Storage Room in Bldg. 9766. The Analytical Laboratories, for quite some time have stored miscellaneous uranium compounds in excess in a small room adjacent to Room #12. These materials are contained in assorted barrels and bottles. Surveyal of the room and the adjacent areas indicated the need for relocating it. Since the storage of radioactive material has posed similar problems elsewhere in the Chemical Division, the Stores and Receiving Department was asked to establish a definite policy with respect thereto in the hope that these nuisance problems can be kept to a minimum. As a consequence, they have decided that all such material will henceforth be stored in the relatively remote vault at the west end of Building 9766. Arrangements have been made to move this material in the poriod to follow.

D. Shipment Surveys

One hundred and seventy-six (176) lots of equipment were checked for alpha, beta and/or gamma activity in accordance with Standard Practice Procedure "20-A for release of property for shipment from the Y-12 Area.



II. SPECIAL SURVEYS

A. Company Issued Clothing. In rebruary of 1948 Management established a policy with respect to the issuance of protective clothing which, in effect, stated that such clothing would be issued largely on the basis of authorization of this department; such authorization was to be based only on the possibility of exposure to radioactive contamination and not routine industrial hazards.

Since nothing had been done previously on the monitoring of clothing, some sort of survey was indicated in order that this responsibility could be carried out effectively. Accordingly an Alpha Clothing Counter was built and installed in the main laundry at which point all incoming clothing was checked for alpha emitting contamination as follows:

Shirt Measurements

- 1. Shirt front (from waist line to 10 inches above)
- 2. Shirt Sleeves (inside and out) (from cuff to 10 inches above)

Trouser Measurements

- 1. Trouser front (from waist line to 10 inches below)
- 2. Trouser legs (inside and out) (from cuff to 10 inches above)

No effort has been made to check for beta and gamma contamination because in only very special instances easily spotted beforehand would such contamination be due to elements other than uranium.

The survey has been in progress for the past three months and the clothing can be classified into three categories, viz., (1) non-contaminated clothing; (2) clothing intermittently contaminated; and (3) regularly contaminated clothing. An effort is now being made to check more closely on the uniforms which fall in the second category and the departments in which they are found. It is hoped that within the next two periods some definite conclusions can be reached with respect to the departments and/or individuals eligible to receive company issued clothing.

The following table is a summary of clothing measurements taken to date:

	Uniforms :	Shirts		Trousers	
 Dept. No.	Checked	Contaminated	Not Contaminated	Contaminated	Not Contaminated
A124	40	8	32	8	32
Alen	9	4	5	.5	4
Ales	67	6	61	6	61
Al3N	71	9	62	10	61
Alst	16	1	15	1	· 15
alan	48	11	37	21	27
Al5N	46	2	44	7	39
A16N	30	3	27	4	26
Al7N	120	28	92	38	82
A121.	4	1	រ	1	3





Ş	Uniforms	Shi	Shirts		Trousers	
Dept. No.	Checked	Contaminated	Not Contaminated	Contaminated	Not Contaminate	
es es	36	13	23	18	18	
Blat	5S	14	44	18	40	
E127	113	16	97	30	83	
B131	44	13	31	12	32	
CSIE	31	5	26	5	26	
412g	31	2	29	4	27	
HIZL	30	1	29	4	26	
и123	21	0	21	0	21	
Totals	815	137	57 8	192	623	

III. PERSONNEL MONITORING

A. Hand Counts

Hand Count Totals, June 1 -- June 30, 1948

De⊃ t ∘	Total Left Hand Counts	Total Right Hand Counts	Total Laft Hand Above-tolerance Counts	Total Right Hand Above-tolerance Count
Alan	47	47	g	13
	53	53	52	52
al 5 m				
algn	49	49	17	18
Al7H	258	258	42	39
E12C	1955	1955	308	274
E12E	2741	2741	636	711 .
81 2L	1276	1276	502	492
H12D	202	202	11	11
#12P	2961	2961	42C	479
M13P	782	782	406	451
Grand Totals	10,324	10,324	2,401	2,520

B. Personnel Moters

A total of one hundred and sixty-two (162) film badges and finger film pads worn by personnel in the Assay Laboratories, Radiography Shop, Spectroscopy Laboratory and "Metal" Machine Shop were processed during the period. None showed evidence of total body exposure in excess of 0.1 r per day. The total number of pen chamber readings recorded was 986.

IV. INSTRUMENTATION AND CALIBRATION

A. Calibration Shack

Management has requested that an attempt be made to provide the required facilities for film and instrument calibration within an existing, but unused building. In accordance, therewith, the Engineering Division is surveying the various stand-by buildings in an effort to find the best location. Nothing can be reported with respect to the procurement of a radiation source.





B. Instruments on Order

Four (4) Survey Meters, Beta Gamma (SEC-7A). One (1) Survey Meter, Alpha, Eeta, Gamma (SEC-3C). Three (3) 'Hinometers (AE-2A).

C. Instruments being Fabricated

One (1) Beta, Gamma, Hand & Foot Counter (HELL Model). Two (2) "Walkie Squawkies."

Part III - Industrial Hygione

I. GENERAL

Progress in Phase II of the program outlined in the last period report has been retared this month in order to survey the literature*, establish the procedure, organize the facilities, and train the recently hired Medical Technician for urinary uranium determinations. Some time was also devoted to the performance of requested services.

II. ESTABLISHMENT OF A PROCEDURE FOR THE DETERMINATION OF URANIUM IN URINE.

A. Procurement of Equipment and Materials

One (1) model "R" fluorimeter has been obtained from the Chemical Division. Five (5) gold plates were obtained from stores and five (5) fusion dishes have been formed. Nineteen (19) additional plates will be obtained and formed into dishes in the near future. This total of twenty-four (24) dishes will provide for the analysis of ten (10) duplicate samples daily.

The Isotopes Development Department has agreed to provide the Medical Department with standard U solution and with standard fusion flux.

B. Development of Procedure

Excellent purification has been obtained by means of a single penta-ether extraction; and perchloric acid treatment of the original sample not only is unnecessary but actually lowers the results by 25 to 50% through apparent physical loss during ignition, at which time a mild explosion occurs.

Difficulty was encountered at first with regard to determining a consistent calibration factor. This factor is becoming quite consistent now, however, as the result of improvement in technique.

Clark, F. E. and Grimes, W. R.; "Determination of Uranium by Fluorescence"; H-1.740.10; Hay 28, 1948.



^{*}Neuman, %. F.; Fleming, R. W.; Carlson, A. B.; and Glover, N. "The Fluorophotometric Determination of Uranium in Biological Material," University of Rochester, Rochester, New York. December 5, 1947.

Hurd, F. W. and Fox, J. S.; "The Determination of Uranium Alpha Activity"; K-89; December 5, 1947.



it has been predicted that the limit of detection for the instrument would be of the order of grame I/ml. Perhaps an added factor of 100 could be obtained by concentrating 100 ml. volumes of the original sample by evaporation prior to purification. Thus far 25 ml. samples spiked to contain 0.010 Agm. U/ml. have been analyzed and reproducible results have been obtained. On the basis of these, and other studies thus far completed, it is thought that the overall procedure now established will provide detection of 0.001 /mgm./ml. (1 ppb). It is planned to prepare aliquots for alpha-counting from the purified concentrates.

C. Training of the Medical Technician

While setting up the equipment for this determination, the Medical Technician was given an exhaustive orientation in:

- (1) Freliminary review of laboratory techniques with special emphasis on the very low order of magnitude of concentrations to be determined.
- (2) Freliminary practice in the cleaning of fusion dishes.
- (3) Freparation of standards (visual), for practice in microchemical technique and in performing fusion operations.
- (4) Fractice in the forming of fusion disnes, followed by the setual forming of the gold dishes to be used.

This crientation was followed by actual training in the procedure to be used and in the operation of the fluorimeter by Mr. Grimes of the Isotopes Development Department and the Industrial Hygienist.

Part IV - Miscellaneous Staff Activities

SLYIMAR

The seminar is continuing as scheduled. John W. Horfitt is still holding forth on the basic concepts of Nuclear Physics.

REPORTS ADDED TO HP-II FILES II.

No Author Named, "Nuclear Physics Primer," MDDG-1497, November 25, 1947. Fry and Overman, "The Preparation of Very Thin Flastic Films," Clinton National Laboratory, AECD-1800, January 30, 1948.

Snell and Armette, "A Slide Rule for Activation and Decay Calculations," MDDC-734, April 1, 1946. Cantrill, Simeon T., "Industrial Medical Program, HLW," MDDC-602,

November 15, 1946.

Jacobson, Macks and Lorenz, "Hematological Effects of Ionising Radiations," CH-3864, October, 1947.

Craddock and Lawrence, "Hemophilia -- A Report of The Mechanism of The Bevelopment and Action of an Anticoagulant in Two Cases," MDDC-1076, June 3, 1947,

Voogtlin, Carl, "Toxicity of Certain Heavy Metal Carbonyls--NI(CO)4, Mo(CO)₆, N(CO)₈, Cr(CO)₈, NDDC=1070, March 20, 1945.





Cohn, Waldo E., "Radictoxicity of Inhaled or Ingested Radicactive Products," MDDC-1656, January 27, 1948.

Drinker and Match, "Industrial Dust," HD 7264.
Dallavalle, J. M., "The Industrial Environment and Its Control," HD 7261.

Stuhlman, Otto, Jr., "An Introduction to Biophysics," 2H 349. Lea, D. E., "Actions of Radiations on Living Cells," 2H 652. Glasser, Quimby, Taylor and Teatherwax; "Physical Foundations of Radiology;" QC 715.

Pringsheim and Vogel, "Luminescence of Liquids and Solids," QC 477.

III. MEMORANDA ISSUED

Author	Subject	Recipient	
Struxness, E. G.	"Recommended Nork Periods for Use in Bldg. 9207." July 22,1948	n. N. Benninghoff	
Struxness, E. G.	"Recommendations for Proposed Calibration Facilities." July 28, 1948.	h. D. Lavers	



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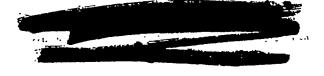
HEALTH PHYSICS - INDUSTRIAL HYGIENE PROGRESS REPORT

June 1 - 30, 1948

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E. G. Struxness

Oak Ridgo, Tennessee July 14, 1948





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HEALTH PHYSICS--INDUSTRIAL HYGIENE PROGRESS REPORT June 1 - 30, 1948

Part I - Introduction

I. GENERAL

A major portion of time and emphasis during the month has been spent in completing Phase I of the Industrial Rygiene program. See Part III of this report. Considerable effort, too, has been given to effecting an improvement in the facilities for calibrating radiation instruments. Some progress is hereinafter reported. The activities of the group, in general, continue to grow and expand as personnel and equipment are made available.

II. ORGANIZATION AND PERSONNEL

A. Industrial Hygienist

John F. Stephens

B. Personnel Meters Technician

Gladys G. Dicus

C. Radiation Inspectors (Surveyors)

Joe H. Hackney Richard W. Brothers Dean H. Reed

D. Instrument Repairmen

J. Howard Campbell Virgil Lovett

E. Secretary

Jean Oliver

F. Personnel Requirements

Personnel requisitions have been submitted to the Personnel Department for the following:

One (1) Health Physicist
One (1) Medical Technician





Part II - Health Physics

I. ROUTINE SURVEYS

A. Air Surveys

One hundred and forty-six (146) samples of air-borne uranium were taken in eighteen (18) different work locations in accordance with the schedule previously reported. See Report #Y-138 dated 3-9-48. Approximately 7% of these samples gave concentrations in excess of the accepted M.A.C. of 150/Mg/M³ while 23% showed concentrations exceeding the established radiation tolerance level of 1225 d/M³/ minute in the following locations:

(1) Building 9206

Eight (8) above tolerance concentrations were obtained during the following operations:

- (a) Room 6 Dumping contaminated ashes into hopper.
- (b) Room 41 Dumping oxide from tray into drums.
- (c) Room 51 Loading the vapor phase reactor,

(2) Building 9212

Eighteen (18) above tolerance concentrations were obtained during the following operations:

(a) Room 44D -

- 1. Weighing "buttons."
- 2. Opening No. 1 dry box door.
- 3. At No. 2 dry box gauntlet portals.
- 4. Dumping reactor at No. 3 dry box.
- 5. At reactor to dry box seal undermeath No. 2 dry box.

(b) Rocm 45D -

- 1. Dismantling molds in salvage dolly.
- 2. Removing carbon from molded metal.
- 3. Removing reactor from hot press.
- 4. Dismantling reactor in dry box.
- 5. Transferring salvage material to dolly.
- 6. Removing carbon dust from dry box.
- 7. Unloading centrifugal caster.
- (c) Room 46D Cleaning burner for inventory purposes.
- (d) Room 50D Loading ball mill in dry box.





(5) Building 9733-4

Four (4) above tolerance concentrations were obtained during the following operation:

(a) Balance Room #2 - Transferring uranium ash from crucible to sample bottle.

B. Water Surveys

Potable water and storm sewer (Bear Creek) samples are taken regularly at predetermined frequencies and locations. The analytical results are tabulated below:

(1) Potable Water

***************************************		Uranium Conc.	Alpha Counts per
Sample No.	Building	parts per billion	minute per 100 ml.
60	9201-4	. 0	0.3 - 0.5
61	9720-2	. 0	0.0 ± 0.5
62	9212	0	0.8 靠 0.5
63	9206	0	0.6 🖢 0.6
64	9204-3	0	0.0 <u>+</u> 0.5
65	9720-5	0	0.0 ± 0.5
66	9711-5	0	0.7 👱 0.6

(2) Storm Sewer

	Analy	7808*
Sampling Point	Uranium ppm	Activity Auc/ml
Drainage Channel (SW of Building 9203-3).	0.013	1 x 10 ⁻⁸
Drainage Channel (SE of Building 9201-4.)	0.005	1 x 10 ⁻⁸
Sprinkling System of Building 9766.	0.023	1 x 10 ⁻⁸
Drainage Channel (SW of Building 9720-5)	0.04	1×10^{-7}
Drainage Channel (100 ft. north of Scarboro Road and Bear Crock Rd. Junction)	0.06	2 x 10 ⁻⁸
Drainage Channel (SW of Building 9720-6)	0.02	2 x 10 ⁻⁸
Drainage Charmel (Sr of Building 9720-1.)	0.01	1 x 10 ⁻⁸
* Relative Error (confidence level, 95%): [Jranium (ppm)	50%



C. Site Surveys

(1) Room 32 (Building 9206)

Reference is made to the last period report in which the condition of this room was described. It has been decided to transfer the white salt process to Room 33 wherein it will be enclosed in a stainless steel hood. Nothing, however, has been done to further the decontamination of Room #32.

(2) Room 44D (Building 9212)

As was reported in the last period report, a study of the potential sources of contamination in this room is being made to determine the extent to which the operations and procedures must be engineered to comply with accepted safety standards. Thus far, nothing conclusive can be reported except to note that sources of air-borne uranium are "spotty" and inconsistent. Each step in the conversion process has been checked and above-tolerance concentrations have been obtained in most of them, but without consistency. All of which is much as would be expected in an operation which requires such extensive handling.

D. Shipment Surveys

Two hundred and eight (208) lots of equipment were checked for alpha, beta and/or gamma activity in accordance with Standard Practice Procedure #20-A for release of property for shipment from the Y-12 Area.

II. PERSONNEL MONITORING

A. Hand Counts

TEM Section has experienced difficulty in key-punching the Hand Score Cards on which the daily hand counts are recorded due to lack of personnel. This is especially true at the first of each month during inventory, with the result that the monthly summary of Hand Scores cannot be prepared in time for inclusion in this report. Rather than withhold publication of this report until this summary cen be prepared, it is thought that the HP-H Progress Report for a given month should contain the Hand Score summary for the preceding month, thus facilitating earlier delivery of the report. Since the last report contained this summary for the month of May, nothing on hand counts will be reported at this writing.

B. Personnel Meters

A total of one hundred and six (106) film badges and finger film pads worn by personnel in the Assay Laboratories, Radiography Shop, Spectroscopy Laboratory and "Metal" Machine Shop were processed during the period. None showed evidence of total body exposure in excess of 0.1 per day. The total number of pen chamber readings recorded was 1012.





III. INSTRUMENTATION AND CALIBRATION

A. Calibration Shack

Management has agreed to provide facilities for film and instrument calibration. The design and construction of such facilities are now under study and it is thought that the work will get underway during the next period. A visit, by interested persons, was made to the X-10 plant during which calibration facilities were investigated. An effort also is being made to secure additional information relative to this problem from various AEC sites in order to insure complete and comprehensive coverage. Since it has been determined that a 26.5 mgm Ra gamma source is adequate for the needs at this site, efforts are being made to secure such a source.

B. Instruments Received

One (1) Berkeley Scaler, Decade (Mod. 1000).

C. Instruments on Order

Four (4) Survey Meters, Beta Gamma (SEC-7A). One (1) Survey Meter, Alpha, Beta, Gamma (SEC-3C). Three (3) Minometers (AE-2A).

D. Instruments being Fabricated

One (1) Beta, Gamma, Hand & Foot Counter (HEW Model).
Two (2) "Walkie Squakies."

Part III - Industrial Hygiene

I. GENERAL

Reference is made to the brief discussion of the proposed Industrial Hygieno program in the last period report which has been organized into the following phases;

- A. Phase I (Definitive). A phase during which a thorough and complete study of the plant with regard to materials, methods and operations will provide a list of potential hazards.
- B. Phase II (Quantitative). A phase during which quantitative determinations of potential hazards will determine the extent to which trey are real.
- C. Phase III (Control). The final phase during which procedures for control and routine monitoring of the real hazards are undertaken to protect the health and safety of plant personnel.

Phase I has been completed and the attached appendix is a summary of





the potential toxicity problems. Other environmental factors, i.e., illumination, heating, humidity, fatigue, ventilation, etc. are not included in the list of potential hazards at this writing since they are relatively unimportant at the moment and will not pose many problems at this site.

Part IV - Miscellaneous Staff Activities

I. SEMINAR

The seminar is continuing as scheduled. John W. Morfitt is still holding forth on the basic concepts of Nuclear Physics.

II. REPORTS ADDED TO HP-H FILES

Heyroth, Francis F., "Thellium, A Review and Summary of Medical Literature," U. S. Public Health Service, 1947.

Nierenberg, W. A. and Williams, Clarke, "Microgas Analysis," Columbia University, November 4, 1946.

Furney, L. C., "Health Hazards in Working with BeO," Argonne National Laboratory, M-3284, December 26, 1946.

McCauley and Dale, "Oral Conditions in Workers Chronically Exposed to Dilute and Anhydrous Hydrofluoric Acid," University of Rochester, MDDC-995, May 27, 1947.

Rekers, P. E., "Honotransplantation of the Mammalian Adult Kidney," University of Rochester, MDDC-1764, February 12, 1948.

Tomphins and Levy, "Impact of Radioactivity on Chemical Laboratory Techniques and Design," Oak Ridge National Laboratory, AECD-1886, April 15, 1948.

Sprague, Geo. F., "Initial Studies of Inhalation Toxicity of Beryelium Sulphate Tetrahydrate Dust," University of Rochester, UR-31, June 14, 1948.

Young, G.; "Rough Draft of a Bibliography on Shielding," ORNL, ORNL-47, May 26, 1948.

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III. MEMORANDA ISSUED

Author	Subject	Recipient	
Struxness, E. G.	"Recommendations for Handling Miscellaneous Radioactive Material Based on Experience with Element 61." June 5, 1948	Dr. E.D. Shipley	
Strumess, E. G.	"The University of Rochester Visit." June 14, 1948	Dr. C. E. Larson	





Struzness, E. G.	"Decontamination of Room #32, Building 9206." Jume 16, 1948	mr. J. M. Herndon
Struzmess, E. G.	"Bauer & Black Tapes for Use in Finger Film Pads." June 23, 1948	Mr. W. J. Kelley
Strumesc, E. G.	"Storage of Contaminated Equip- ment." June 24, 1948	Mr. W. Watson

Health Physics--Hygiene Department



A Proliminary Definition of Industrial Poisons

C&CCC Y-12 Plant July 1, 1948

HENRIAL SLASSIFICATION	Potential eazards	BUILDING	AREA	OPERATION
Atmospherio Conteminants				
funse and/or		9206 9204-3	Room 51 Chem. Recovery	Transfer from conversion reactor to charge bottle. M and L units disassembly and cleaning.
M <u>i</u> 8t8		9201-4	Servicing Recovery	
		9731	Servioing Recovery	Same as 9204-3 Mechanical Servicing Area. Same as 9204-3 Chemical Recovery Area.
		Process Bldgs. in Standby	methe cervicing Track	
	UO2F2	9212	Room 16 Room 49A	Eveporation and ignition of ${ m UO_2F_2}$ to ${ m U_3O_8}$. Hex dissolution.
	-		A & 50B	Hydrofluorination of UO2F2 to green salt.
			SIC Rooms 52A 12B &	Hydrofluorination of UO2F2 to green salt.
		9226	520 Room 58	Hydrofluorination of UO2F2 to green salt. Kydrofluorination of purified oxide to white salt.
	กับ	9212	Rooms 47A & 47B	Peroxide precipitation.
		9026	3 3 3	feroning and transfer of combustible salvage.
		•	40 127	Calcination of "Q" material. Calcination of "Q" material.
	оз	9212 9206	Room 12 Room 22 Room 34	Ignition of "metal" and/or oxides. Mitric acid dissolution with subsequent precipitation. Muffling "K" material.

	эрекаттой	Calcination of "R" material. Calcination of UO ₄ H ₂ O to UO ₅ . Transfer of dry UO ₅ for reactors. Calcination of "Q" material.	Ignition of 00_3 to 0_3^0 8. Ignition of 00_3 to 0_3^0 8. Ignition of 00_3 to 0_3^0 8. Chlorination of 00_3	dighing and igniting of green salt. Grinding and weighing of green salt. Transferring, weighing and loading of green salt. Fransferring, milling, weighing and packing of green salt.	packing of green lite	Lymonthan induction of the control o	Ammonia precipitation of $00_2(NO_3)_2$. Ammonia precipitation of $00_2(NO_3)_2$.	
	ARBA	Room 40 Room 41 Room 51 Room 127 Room 127	1 2 4 4 Recovery	Room 12 Room 16 Room 44D Room 50A & 50B Rooms 51A,51B,51C	52A,52B,52C 35 31 39	Recovery Servicing	Room 9 Room 12 Room 47A Room 22 Room 24 Room 25 Room 31 Room 32 Room 33 Moom 35 Room 35 Room 35 Room 140	
	BUILDI NG	9206	9733 -4 9204-3	9212	9506	92043	9766 9206	
	Potentlal Hazards	žo _ū		ኒ ተ			(WH4)2 ^U 2 ^O 7	
<i>1957</i>	CEMERAL CLASSIFICATION	A. Urenium, etc. (cont'd)						

GENERAL GLASS IF I CATION	POTENTIAL HAZANDS	BUILDING	AREA	OPERATION
A. Uranium, eto. (cont'd)	(инд) ₂ 0 ₂ 0 ₇	9733-4	Room 1 Room 2	Aumonia precipitation of ${ m UO_2(MO_3)_2}$. Anmonia precipitation of ${ m UO_2(MO_3)_2}$.
•		9203	Room 4 Isotopes Lab. Room 19	Amnonia precipitation of ${\rm UO_2(NO_3)_2}$. Amnonia precipitation of ${\rm UO_2(NO_3)_2}$. Preparing samples for mass spectrometer.
	g ₀ 0	9206	25 59 108	of UO2 to green of UO2 to green of UO2 to green
		N N N N	Nooms bua & bub Rooms 51A, 51B, & 51C Rooms 52A, 52B,& 52C	bus phydrofluorination of UO2 to green salt. 51B, & 51C Hydrofluorination of UO2 to green salt. 52B,& 52C Hydrofluorination of UO2 to green salt.
	$\sigma_{5}\sigma_{8}$	2126	Room 12 Room 16	Ignition of green salt to 0.00_8 . Evaporation and ignition of 0.00_8 Fz to 0.00_8
	·	9206	Room 6 Room 29 Room 34	Grinding and weighing of UgO8. Burning of combustible salvage. Processing of "Q" meterials. Muffling of "R" meterial. Discrembly of "R" bores and expaning of cambons.
		9204-3	Cham. Recovery	Disassembly of "E" units.
		9201-4 9733-2	Chem. Recovery Analytical Service	Same as 9204-3 Chemical Recovery
		9733-4		Witrio acid dissolution of U ₅ O ₈ . Nitrio acid dissolution of U ₅ O ₈ .
			3 48 49 50 1 44 44 49 50 1 44 44 49 50	Rell milling of UgOs. Transfer following ignition of UO ₅ to U ₅ O ₈ .
	ugsc12	9206 9204-3	S1 Regovery	Vapor phase conversion of UO _S to UCl ₄ . Diseasembly and cleaning of E, M, and L units.
		9201-4	Process Area Recovery Recovery	Precipitation of E. M. and L. wash. Same as 9204-3 Chemical Recovery.
		9733-4	Room 1 Room 2	Water dissolution of $\mathrm{UCL}_{4}^{\bullet}$ where dissolution of $\mathrm{UCL}_{4}^{\bullet}$ and the standard of $\mathrm{UCL}_{4}^{\bullet}$

OPERATION	Processing of "q" materials. Disassembly of "E" units. Disassembly of "E" units. Disassembly of "E" units. Recovery of uranium isotopes.	Casting and machining of enriched metal. Machining normal metal. Welghing and igniting metal. Garbon analysis. Washing and igniting metal. Chip sempling. Transfer and ignition of chips. Milling, shaping, sawing and grinding metal. Chip recovery. Processing of "Q" material. Processing of "R" material. Disassembly of "E" box and soraping of carbons. Disassembly and cleaning of E, M, and L units. Disassembly and cleaning of E, M, and L units. Disassembly and cleaning of E, M, and L units. Disassembly and cleaning of E, M, and L units.	Burning, welding, grinding, and sanding of lead materials. Machining and grinding of lead stock. Sheet metal work and lead sheet. Lead burning and repair of battery plates. Lead burning and repair of battery plates. Lead base paint spraying. Charge bottle filling and removal from units. Charge bottle handling. Preparation of special thallium charges. Preparation of special charge materials. Cleaning of used M and L units. Metallizing Cutting, grinding, polishing and corrosion testing.
AREA	Room 29 Chem. Recovery Chem. Recovery Chem. Recovery Isotopes Leb.	Area A Area C Room 4 Room 12 Sub-basement Room 4 Machine Shop Room 17 Room 34 Room 35 Chem. Recovery Chem. Recovery Chem. Recovery	Millwright & Pipe Shop Machine Shop Sheet Metal Shop Welding Shop Battery Repair Foundry Area Paint Shop Chem. Recovery Room 15 Room 16 Room 17 Chem. Recovery Room 11 Sheet Wetal Shop Matallurgical Lab.
BUILDING	9206 920 4-3 9201-4 9731 9211	9212 9204-1 9753-4 9766 9206 9204-3 9201-4 9731	9204-3 9709 9712 9738 9769 9204-3 9733-1 9733-1
POTENTIAL HAZARDS	Frantum Carbides	Tranium Metal	Lead Chloride Thallium & Thallium Chloride
GEKERAL	A. Uranium, eto. (cont'd)		B. Other Metal- lio Dusts, Fume and/or Hists

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CLESSIPICATION	POTENTIAL HAZARDS	BUILDING	ARISA.	OPERATION
B. Matalilic Dusts (cont'd)	Соррег	92043	ng Pips:-	Abrading copper parts. Grinding, sanding, burning or brazing copper parts.
		9766		Grinding, machining of copper parts.
		601.6		ohining of copper fork on copper sh
		9738		Motallizing. Motallizing.
	Solonium	9731	Charge Preparation Lab.&Chem. Recovery	Ralogenations, precipitations, filling charge bottles end cleaning of units.
	To llur fua	9731	Charge Preparation Lab.&Chem. Recovery	Helogenations, precipitations, filling charge bottlen and cleaning of units.
	Load	9731	Charge Preparation Lab.&Chem. Recovery	Halogonations, precipitations, filling charge bottles and cleaning of units.
	Antimony	9731	Charge Freparation Lab.&Chem. Recovery	Halogenations, precipitations, filling charge bottles and cleaning of units.
CTEST Y	Cadmium	9731	Charge Proparation Lab.&Ghem. Recovery	Halogenations, precipitations, filling charge bottles and cleaning of units.
	outz	9731	Charge Preparation Lab.&Chem. Recovery	Halogenations, precipitations, filling charge bottlen and cleaning of units.
يدد.	Tuoridas	9212 9733-2 9733-4	Room 9 Room 12 Room 1	Fusion of samples for fluorescent determination. Analyses of fluorides. Fusion of samples for fluorescent determination. Fusion of samples for fluorescent determination.
		9766 9709 9734		of samples for fluorescent on of UF4. flux-covered welding rods isluss of sodium fluoride
	Chromic Acid	9744	Electroplating Shop	Electroplating.

	er gelt mede produktion på septemble skalle gelt gelt gelt gelt gelt gelt gelt g		Į.	
GENERAL CLASSIFICATION	POTENTIAL HAZARDS	BUILDING	AREA	OPERATION
B. Metallic Dusts (cont'd)	Brass	92043 92014 9709 9738 92012	Mech. Servicing Mech. Servicing Machine Shop Sheet Metal Shop Welding Shop Foundry Key & Lock Section	Grinding and brazing of brass parts. Grinding and brazing of brass parts. Machining and grinding of brass parts. Cutting and brazing of brass parts. Metallizing. Bray filling of looks.
: VISTER 13	Gadmium ·	9204-3 9709 9738		Welding and burning cadmium plated parts. Sheet metal work on cadmium parts. Surning and metallizing Metallizing.
<u> Contractor of the contractor</u>	Calcium Oxide	9212 9212	Room 46D Room 16	Grinding calcium metal. Grinding CaO in mortar and weighing samples.
	Boryllium Oxide	9212 9733-1 9766	Room 5 Room 17 Isotopes Physics Lab. Metallurgical Lab.	Room 5 Room 17 Spectrographic analysis (arcing) of BeO. Isotopes Physics Lab-Weighing and filling spectrograph electrodes. Spectrographic analysis (arcing) of BeO. Spectrographic analysis (arcing) of BeO. Hot pressing and pelletizing BeO.
C. Mineral Dusts	Beryllium Alundum	9709 9709 9737 9709	Machine Shop Machine Low Voltage Shop Machine Shop	fachining and grinding of Be metal. Sawing alundum. fachining and grinding.
*	Lava Silica	9709 9709	Machine Shop Kachine Shop	Wachining and grinding. Wet grinding and turning of porcelain. Wet grinding and turning of zircon (silicate).
		9738 9968 9979	Foundry General Paint Shop	

				No. 1979 - A CONTRACTOR OF THE LAND OF THE PROPERTY OF THE PRO
GENERAL GENERAL GENERAL	PO"ENTIAL HAZARDS	EUTLDING	лева	SHOTT SHOTT
Do Gasse and				
Vapors 1. Inorganic	or 6	9212 9753-1	Room 49h. Room 22	Hen dissolution. Modified Hen Process.
الروق الإراضح	T2	9204~3 9205	Track Room 19	Used as carrier charge in track "runso" Dreaking and sealing apsovrometer tubes.
Wek . 소영제	GIFS	92043	Track	Used as cerrier charge in track Truns."
	Fluorins	9204-3	Track	Recrudding calutron filament defining elots during
BEONTS.		9735-1	Room 20	Fluorination of Ms units.
***	belle e konste krystek in	9731 9766	koom 25 Chargo Prop. Lab. ^M ateriale Leb.	Fluorination in charge proparation. Reduction of uranium fluorides in reaction "bomp."
: V.6800	Mrdroren Fluoride	9212	Room 16	Evaporation and ignition of $00_2 { m F}_2 \circ$
% .357	2		50A &	Nydrofluorination of WO.
% ₹.			Rooms old & old Rooms 52A & 52B	of uo.
\$\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\		9026	ម្ល	40
	£1000,00€		Room 32	of vranium oxide to white

÷ .			Room 59	Conversion of UO2 to UFA with HF. Conversion of UO, to UFA with HF.
•		9733-1		Testing of experimental BF Flowmeters.
. જ્હ		97.55-4	Room 2	Evaporation of micro-analytical samples.
	· · · · · · · · · · · · · · · · · · ·	9731	Room 4 Chem. Recovery	eveporation of micro-analytical samples. Cleaning inculators with $\mathrm{H}_{L}\mathrm{H}_{2}$.
	Chlorine	9204-3	Treck	Used as carrier charge in track "runs."
		3731	Charge Prep. Lab.	whormarion of miscellaneous charges. Preparation of miscellaneous charges.
	Fluorine-Trichloride	2204-5	Track	Decrudding calutron filmment defining slots during "run."
	Bromine	92043	l'rack	Jsed as carrior charge in track "runc."



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GENERAL GLASS TVICAT IOT	POTENTIAL KAZARDS	BUILDING	AREA	OI/BRAT IONS
1	i.		troplating Shop	Electrop lating.
Vapors (cont'd)	302 - 1204	9026	Room 22 Room 24	Dissolving $\mathbf{UO_4}_{\bullet}$ x $\mathbf{H_2O}$ in nitric acid. Dissolving $\mathbf{UO_4}_{\bullet}$ x $\mathbf{H_2O}$ in nitric acid. Dissolution of symmonium distances in nitric acid.
				Leaching "R" majorial. Leaching unresolved majorial.
		9204-3	Cham. Recovery	Lucching, dilution for line wesh and electrostripping.
		9709 ·	190 Late of the State of the St	Aro welding. Washing units.
	limonia .	2012	Room 463	Ammonia precipitation.
	War and the second	9206	John 27 A Room 22	Handling and storage of amnonium carbonato.
	•		Room 24 Room 25	
		9733-4	Com 108 Rom 140 Rom 1	Ammonia precipitation. Ammonia precipitation. Ammonia precipitation.
	Sydrogen Sulfled and Sulfur Diozide		Room 12 ghargo Prop. Lab.	Sulfiding in rere earth analysis. Used in Rehnium research.
		9211 3735-2	Leotopes Lab. Analytical Services	Analytical precipitations. Analytical precipitations.
	Carbon Monoxido	9212	fotor Repair	Testing motors.
•	Ig Vapor	9211 3737	Isotopes Lab. 161eod Gago Shop	Bleatrolysis. Cleaning mercury and servicing gages.
	euozo	9709 92043	Welding Shop (41læright & pipe- fitters Shop	Arc wolding. Arc wolding.
	letra-ethyl lead	9751	Niargo Prop. Lab.	reparation of charge



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GENERAL, CLASS IVE COLUMN	POTENTIAL HAZAKDS	HILDIRU	भ्राम्	WERATA TOWN
(a (a	Benzeno	9737 9709	Low Voltage Shop Solding Shop	Thinning varnish. Closning.
	Ethyl Ether	9212	Room 12 Room 47B	Ether extraction process. Ethel extraction process.
- <u>/ / / / / / / / / / / / / / / / / / /</u>	Carbon Petrachloride	9206 9204 -3	Room 51. Millwright & Pipe-	Veror phase chlorination of ${ m UO}_{\cal S}$, Gleaning parts.
	Trichlorathyleno	9204-8 9737 9201-4 9709	ry Shop ing Shop	Disposal of trichlorethylene used for oleaning unition Trichlorethylene vapor degreasing. General unit purts cleaning. Cleaning and degreasing.
	Parchlorothylene	9026	Room 108	Preparation of Machine Shop Coolent.
· · · · · · · · · · · · · · · · · · ·	Ethylene dichloride	9204-3	fillwright & Pipe- fitter Shop	Cleaning.
25.5	Varsol	9204-3 9201-4	Moch. Servicing Moch. Servicing	Oleaning of mechanical parts. Cleaning of mechanical parts.
	Pyridine	9733-2	Коот вА	Water determination in transformer oil.
	Penta-ether	9212	Room 9 Rocm 461.	P.E. extraction P.E. ontraction
		9753-4	Room 101	Purification by high vecuum distillation.
	Hoxach lopropene	9753-2	Room 1	Preparation of charge material by HCP process.
	Fluorocarbons	9212	Room 49A	Collected by-product for return to K-25.
II. Skin Irritants	Chloroacryl trichlo- ride	9733-1	floom 15	Organic complexing.
	U metal machining coolent	9212	Room 46D	Maching ureniumo

General Class if i cat toh	POTENTIAL HAZARDS	BUILDING	ARRA	OPERATION
II. Skin Irritants (cont'd)	Perchlorethy lene	9206	Room 17 Room 108 Yaching Shop	Chip recovery. Proparing the coolant Machining uranium.
	Cutting oils	9709 920 <u>4</u> –3 9766	Machine Shop Millwright & Pipe- fitters Shop Student Shop	Machining. Machining. Machining.
gg war y was ng ya	Glass Wool Insulation9204-5	9204-5	Millwright & Pipe- fitters Shop	Removing insulation from steam lines.
	Organic Solvents 1. Carbon tetrachlo- ride 2. Trichlorethylene 5. Ethylene Dichlo- ride 4. Ether 5. Kylene 5. Glyptal	Genoral	Genoral	feneral cleaning and miscellaneous process operations.
	Carbon Dust	9709 9736 9733 -3	Carbon Shop Carbon Shop Room 14	Machining carbon. Machining carbon. Pulverizing used carbon parts.
	Aetallic Dusts	9709 9766 9204 3	Machine Shop Student Shop Millwright & Pipe- fitters Shop	Mechining, grinding and abrading. Machining, grinding and abrading. Machining, grinding and abrading.
-	Oaki te	9712	Repair	Claaning of motors.
	3elankrola	9704-2	Office Services	Roll and blanket cleaning.
	Forma ldohyde	General	General	Spray painting with fireproof paint.
	-			

E. O. LONG 12 CENTRAL FILES

C-1139 (3-45)

Index No	Y-181/[R	
	Contains 12 Page	8
	by Barton	

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C. R. I. O.

Classification A SSF EU

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Y-12 PLAM

W-7405-Eng-26

HEALTH PHYSICS - THOUSTRIAL HYGIENE PROGRESS REPORT

May 1, - 31, 1948

E. C. Strumess

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Oak Ridge, Tennesses Juna 16, 1948







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HEALTH PHYSICS - INDISTRIAL HYGIENE PROGRESS REPORT 124 1 . - 31 . 1948

Part I - Introduction

I. GENERAL

The beginning of this period witnessed the organization of a new group within the Medical Department, known as the Health Physics-Hygiene Section. The present author, who is in charge of the section, reports to the Medical Director, Dr. P. D. Scofield. The functions of the HP-H Section will be concerned with the numerous problems relating to protection of plant employees against hazardous contaminants, both chemical and radio-active. This combined function, heretofore, has been carried out separately by a Hygienist within the Medical Department and the Special Hazards Group.

Noteworthy visits to the plant during the month were made by Dr. A. G. Kammer, Medical Director, C&CCC, South Charleston, West Virginia; Dr. A. L. Holland, Jr., Chief Medical Advisor, Office of Oak Ridge Directed Operations, AEC; and Mr. W. H. Ray, Health Physics Consultant, AEC.

II. ORGANIZATION AND PERSONNEL

A. Industrial Aygienist

John F. Stephens

B. Personnel Maters Technician

Gladys G. Dicus

- 3. Radiation Inspectors (Surveyors)
 - J. H. Hackney
 - R. W. Brothers
- D. Instrumentation and Calibration
 - J. M. Campbell
 - V. Lovett
- E. Personnel Requirements

Personnel requisitions have been submitted to the Personnel Department for the following:

- (1) Realth Physicist
- (1) Medical Technician
- (1) Radiation Inspector
- (1) Secretary





I. ROUTINE SURVEYS

A. Air Surveys

One hundred and sixteen (116) samples of uranium air-borne concentrations were taken in eighteen (18) different work locations in accordance with the schedule previously reported. See Report #7-138 dated 3-9-48. Approximately 20% of these samples gave concentrations in excess of the legal K.A.C. (150 ug/M3) while 27% showed concentrations exceeding the established radiation tolerance level of 1225 d/M3/Finute in the following locations:

(1) Building 9201-4 (Track Room)

Two (2) above tolerance concentrations were obtained during the tank cleaning operation. Operators wear respirators.

(2) Euilding 9204-3

Eight (8) above tolerance concentrations were obtained during the following operations:

(a) Major Repair Area

Welding (grinding the weld) liners and H & J Sub-assembly repair.

(b) Chemical Recovery Area

Washing liners and disassembling "H" units.

(3) Euilding 9206

Eleven (11) above tolerance concentrations were obtained during the following operations:

(a) Room 6

Dumping contaminated ashes into hopper. Operator wears respirator.

. (b) Room 32

Ammonia and peroxide precipitation of white salt. See item C.2 below.

(c) Room 41

Dumping oxide. Operators wear gas masks.

(d) Room 51

Loading the vapor phase reactor! Operators wear gas masks.

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(4) Boilding 9212

Eight (8) above tolerance concentrations were obtained during the following operations:

(a) Room 44D

Loading reactor prior to conversion. An additional dry box, joined to the dry box in which the loading takes place by means of a sealed access chamber, has been installed. This equipment has improved conditions immeasurably. It appears, however, that steps taken to operate these dry boxes under slight negative pressure are indicated.

(b) Room 52A

Unloading salt from ball mill. Operator wears a Dustfoe respirator.

(5) Building 9761

Two (2) above tolerance concentrations were obtained during the bricketting of ohips.

B. Water Surveys

Potable water and sewer (storm and sanitary) samples are taken regularly at prodetermined frequencies and locations. The analytical laboratories are now prepared to report these analyses currently.

(1) Potable Water

The analyses of four (4) samples taken during the period continued to indicate that the drinking water at this site is not contaminated. The usual results appear in the range of $0.4 - 0.1 \pm 0.5$ alpha counts per minute per 100 ml and 0 ppb.

(2) Storm Sewers

The analyses of eight (8) samples taken to date are summarized as follows: *

See Table I.



The state of the s

	Analyses				
Sampling Point	Uranium ppm	Activity AC/ml			
Process Water (Recirculated) of Building 9212 Process Water from Buildings 9733-1, -2, -3. Drainage Channel (Intersection of Scarboro Road and Bear Creek) Drainage Channel (Intersection of 4th Street and Channel) Drainage Channel (SW of Building 9906) Storm Sewer Main (SW of Buildings 9211 and 9207) Drainage Channel (SW corner of Building 9201-4) Storm Sewer Main (Between Buildings 9744 and 9510-2)	0.002 0.052 0.0076 0.023 0.023 0.011 0.024	-8 2 x 10 -5 1 x 10 -9 1 x 10 -8 1 x 10			
* Relative error (Confidence level, 95%) 20%					

C. Site Surveys

(1) Room 23 (Building 9735)

This room was surveyed following the spectrographical work with element 61.* It was found to be uniformly and extensively contaminated. Efforts were made to decontaminate the area and equipment with ammonium citrate solution (pH = 4.5) with but moderate success. Pending disposition of equipment, it was decided to immobilize the residual beta activity on surfaces with three (3) coats of lead pigment paint.

(2) Room 32 (Building 9206)

Persistant above-tolerance, air-sorne-concentrations and extremely high hand counts led to the decision to stop this operation and attempt to improve conditions in the area. Sorveyal of the surfaces in the soom and equipment showed a uniform and high level of alphanictive contamination with only a slight degree of beta, gamma activity. Thorough vacuuming of the general area and repeated washing of the surfaces with soap and water and carbon tetrachlorice brought the level down to a point where the residual alpha activity can be immobilized adequately

^{*} CHI Mica Window Probe and Higginbatham Sca. cr was used.



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with paint. Same consideration is also being given to confinement of the entire process in an efficient hood.

(3) Room LAD (Building 9212)

Continued efforts are being made to improve conditions at this location. Repeated surface checks and correlation of the results with the air-borne concentrations obtained in this room dictated the need for something more adequate than the single dry box originally installed. A second dry box, joined to the first by merns of an access chamber, has now been installed and shows some improvement. Whether this will be sufficiently adequate remains to be explored. It is thought that these dry boxes may have to be operated at a slight negative pressure and exhausted through an efficient filtering medium to completely overcome what appears to be the main source of contamination.

(L) Radiography Shop (Building 9212)

In cooperation with the Special Hazards Group, a thorough survey of the penetrating radiations in this area has been completed and a report of the findings will be issued shortly. It was found that the exposure level at the fence which surrounds the shop (with the radium source in operating position) is approximately three (3) times the maximum allowable exposure level of 12.5 mr/hr, This fact was immediately made known to the personnel who frequent this area and, pending relocation of the fence, recommendations were submitted to protect personnel from Meedless exposure.

D. Shipment Surveys

Two hundred and forty-nine (249) lots of equipment were checked for alpha, beta and/or gamma activity in accordance with Standard Practice Procedure #20-A for release of property for shipment from the Y-12 TOR.

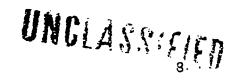
II. PERSONNEL HONITORING

Hand Counts Αo

Eight (8) Chicago Model, two-fold, Alpha Hand Counters have been fabricated and installed in Buildings 9212 (one in each of the four wings and one at the exit portal), 9206, and 9204-3 (one in the Chemical Recovery Area and the other in the Mechanical Service Area). Hand Score Cards, addressographed and distributed by Office Services, are provided in card racks adjacent to the counters. At present, each employee is required to record a minimum of two (2) counts each work day, i.e., before lunch and before leaving at the end of the day, and encouraged to record results of all hand counts taken during the day. At the end of each week the used cards, having been replaced by new cards, are sent to the IBM Section where key cards are punched from which weekly and monthly summary reports are derived.







The following table shows totals of the hand counts recorded thus far:

Table II

Hand Count Totals, May 10 - May 31, 1948					
Dapt.	Total Loft Hand Counts	Total Right Hand Counts	Total Left Hand above- Tolerance Counts	Total Right Hend above- Tolerance Jounts	
Alev	15	15	7	7	
Alet	9	9	0	0	
Alen	49	49	24	27	
Alen	33	33	· 21	17	
A16H	35	35	5	7	
A17N	201	201	66	52	
B12C	964	95 <u>4</u>	240	239	
812H	1273	1273	315	326	
B12L	1155	1155	373	371	
H12D	43	43	3	4	
M12P	1970	1970	501	547	
MISP	514	514	269	269	

B. Personnel Maters

A total of one hundred-forty-four (144) film badges and finger film pads worn by personnel in the Assay Laboratories, Radiography Shop, Spectroscopy Laboratory and "Metal" Machine Shops, were processed during the 'period and none showed evidence of total body exposure even remotely approaching 0.1 r per day. The total number of pen chamber reading recorded was 592.

III. INSTRUMENTATION AND CALIBRATION

A. Fixed Instruments

The instruments located in the B-3 Instrument Laboratory are:

- 1. Alpha Parallel Plate Counter
- 2. Simpson Proportional Alpha Counter
- 3. GM Mounter (Scale of 64)
- 4. GM Mica Window Prove and Higginboatham Scaler
- 5. Poppy Monitors (3)
- 6. Howler (Proportional Alpha Counter)
- 7. Neutron Counter
- 8. Beta, Gamma Hand and Foot Counter
- 9. Weston Densitometer
- 10g Alpha Laundry Counter

B. Portable Instruments

The number of portable instruments used regularly for assorted measurements are:

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- 1. Zous (2)
- 2. Zeuto (2)
- 3. Walkin-Poppy (3)
- 4. L & W Survey Meters (3)
- 5. Victoreen 263 (3)
- 6. Fortable GM Survey Counter (Mica Window)
- 7. Cutie Pie (2)
- 8. Victoreen Hinometers (5)
- 9. Filter Queen Air Samplers (4)

C. Personnel Meters

One hundred (100) Victoreen Pocket Chambers and three dozen film badges are now in use. An additional one hundred (100) Pocket Chambers together with forty-eight (48) film badges have been placed on order. Oak Ridge National Laboratories Health Physics Division has provided a few of the new plastic film rings for use at this site, but until production shipments are available, the rubber film pads are used at present in the "metal" shops.

D. Calibration

In general, calibration facilities and procedures are in need of very considerable improvement. The limiting factors at this point are: (1) lack of trained personnel, (2) lack of an adequate source, and (3) lack of a centrally located area in which to make all calibrations. The HP-H Section will shortly be provided with the full time services of two radiation instrument mechanics to do this work in addition to whatever routine maintenance is required. Also, an effort will be made to secure a 26.5 mgm radium gamma source for use in this work. Some thought has been given to setting up a calibration shack, but nothing has been done as yet.

(1) Radium Calibrations

A calibration plate for use in calibrating badge film and pen chembers has been built and is in use. The calibration of film, however, is a slow procedure since the only source available is a 4.77 mgm Radium source. Integrated exposures to gamma rays of 100, 200 and 300 Wr are used in calibrating the pen chambers while exposure of 100, 250, 500, 750, and 100 Mr are used in calibrating the Dupont #552 film.

(2) Uranium Calibration

Since it is desirable to calibrate a detecting device to the same conditions which are to be measured, the film pads are calibrated to predetermined exposures of beta and gamma radiation (again 100, 250, 500, 750 and 1000 Mr) coming off the surface of normal uranium metal. The device for incorporating the metal has been designed but it is not yet fabricated.



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1. GENERAL

During the period, emphasis has been placed on developing the definitive approach to the problems in Industrial Hygiene at this site, the conclusion of which should quite clearly picture the potential hazards which exist here. It is expected that the second phase, which logically follows, will require preliminary quantitation to the extent that the real hazards become obvious, at which point the methods of control and routine monitoring can be predicted. It seems reasonable to assume that, within a period of from six to twelve months, a well planned routine program can be expected.

Phase I will consist largely of seeking and collecting and organizing a great deal of detailed information on the processes, procedures and materials in use at this plant. Considerable progress toward that end has been made to date and it is hoped that this definitive phase will be completed during the next period.

II. SPWCIAL SURVEYS

A. Field Surveys

(1) Ventilation Survey of Laboratory (Building 9735)

An investigation of the adequacy of ventilation in this laboratory was made with a view to determining the existence of fume pockets in certain areas which might constitute hazards. Results of the survey showed that face velocities of the hoods were actually about 110 f.p.m., that general ventilation was good with about 20 air changes per hour, and that two relatively small areas were pocketed. It was recommended: (1) that all work which might give rise to noxious fumes be confined to the hoods; (2) that, should heavy fuming develop in either hood section, face doors of adjacent hood sections be lowered to provide additional face velocity; and (3) that an office type fan be operated at all times in the vicinity of the pocket areas.

(2) Ventilation in Shoe Stores (Building 9704-2)

A preliminary survey of ventilation facilities in this area was made following complaints of the existing unpleasant oder. While it was felt that no health hazard exists here, recommendations for improving the condition were submitted. Any additional ventilating equipment would have to be justified on "nuisance" value only.

(3) Surveys in Progress

- a. Phosgene in Room #51 of Building 9206.
- b. Carbon Tetrachloride in Office Services Machine Shop of Building 9704-2.
- c. Adequacy of ventilation in Laboratories #13 and #16 of Building 9733-3.
- d. Beryllium copper metal in Building 9766.



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e. Use of Cerium Chloride and Cerium Bromide in Building 9731.

f. Use of Selenium Metal and Selenium Oxide in Building 9731.

Part IV - Miscellaneous Staff Activities

I. SEMINAR

Lectures are given on Monday morning of each week for members of HP-H Section and the Special Hazards Group. It is planned to continue these training sessions regularly over an extended period of time and the subjects to be covered will include Nuclear Physics, Radiochemistry, Instrumentation and Calibration, Biological Effects of Ionizing Radiations, Health and Hygiene, and Industrial Enviorment and Its Control. John W. Morfitt of the Special Hazards Group has presented three lectures thus far on some of the basic concepts of Nuclear Physics.

II. REPORTS ADDED TO HP-H FILES

Howland, J. W. and Warren, S. L., "The Effects of Irradiation From the Atomic Bomb on the Japanese," "niversity of Rochester, MDDC-1301, 10-15-47.

Huffman, John R., "Nuclear Engineering," MDDC-1302, 10-29-44.
Ballow, C. O., "Cutie Pie, A Portable Instrument," MDDC-997, 10-22-45.

Guzman Barrow, Ed S., "Some Aspects of the Biological Action of Radiation," PDDC-484, 11-26-46.

Price, Schwartz, et all, "Design and Construction of Sensitive Fluoraphotometers, Part I," Argonne National Laboratories, ANL-4113, 4-20-48.

Snyder, Thomas M., "Theory of Ion Chambers," MDDC-475, 10-30-46.

Spiegl, Howe, LaFrance, "Tomicity of Hexachlor Propylene and Trichloracrylyl Chloride," MDDC-1715, 2-9-48.

Blair, et all, "Quarterly Technical Report," University of Rochester, UR-21, 4-23-48.

Warren, S. L., "Mon-Electronic Methods for Detecting Small Amounts of Radiation," Medical Section, U. S. Engineer Office, M-70, 1-22-48.

No Author Named, "General Health Manual," HRAC-21a, 8-18-47. No Author Named, "Scientific Progress Report," Brookhaven National Laboratory, July-December, 1947.

Dounce, et all, "Catalasuria As A Sensitive Test for Uranium Poisoning," WDDC-252, 7-1-46.

III. MEMORANDA ISSUED

Author	Subject	Recipient
Stephens, J. F.	"Use of Selenium Metal and	Dr. C. P. Keim
Stephens, J. F.	Selenium Oxide in Building 9731" "Use of Selenium Metal and Selenium Oxide in Building 9731"	Dr. C. P. Keim
Stephens, J. F.	Supplementary 5-13-48 "Use of KMnOL in Hand Decontamination" 5-18-48	E. G. Strumess

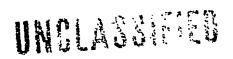




Author	Subject	Recipiont
Strumess, E. G.	"Alpha Surface Contamination in Building 9212" 5-19-48	J. H. Hernden
Struxness, E. G.	"Alpha Surface Contamination in Building 9206" 5-19-48	J. M. Herndon
Stephens, J. F.	"Ventilation Survey of Laboratory in Building 9731"	Dr. C. P. Keim
Stephens, J. F.	"Sub-Activity Committee in Dept. A12D" 5-25-48	L. W. Bagwell
Stephens, J. F.	"Odor in Shoe Storage Area, Building 9704-2" 5-28-48	B. T. Whitaker

Aw. J. Thurness Health Physics-Hygiene Section





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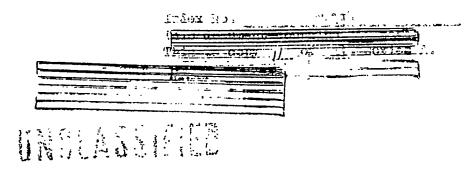
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PEALTH PEYSICS PROCEESS REPORT Fabruary 1 - 29, 1948

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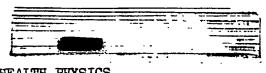
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HEALTH PHYSICS

1. Radiation Surveys

Personnel Monitoring

(1) Hand Counts

Hand contamination in the Uranium Machine Shop of Bldg. 9766 remains substantially as reported for the previous period. Over 700 hand counts were recorded during the month covering the range from background to 2,200 counts per minute with the median count at about 125 counts per minute. This situation is not expected to improve until the operators can wear gloves constantly. The kid-leather gloves designed for this purpose have not yet been received.

AEC Alpha Hand Tolerance - As yet, no official work has been received from the Atomic Energy Commission concurning our request for an interpretation of the uranium alpha hand tolerance.

(2) Film Monitoring

One hundred sixty-eight (168) film pads were used in monitoring the Uranium Machine Shop personnel during the period. Continued assistance from the Health Physics Division of Oak Ridge National Laboratories has facilitated the organization of this program. They have provided the materials, developed the exposures, and run the calibrations. The results obtained this far, while indicating the need for routine film monitoring, are inconclusive and inconsistent. It is felt that the techniques involved in assembling the pads, in locating the pads on the wearer's hand, and in subsequent developing are largely responsible for the indeterminate results. A significant number of the films are weathered, light struck or completely blacked out due to such agencies as pressure and moisture and, until the techniques are standardized (this is a relatively new method of film monitoring), the data will be difficult to analyze. Perhaps film rings or wrist bands will have to be used. At any rate, the problems involved are under scrutiny and it is hoped that improved techniques will result.

b. Air Survey

A tentative schedule for routine air sampling in this plant has been determined and now being followed. With time and the accumulation of more data this schedule will doubtless be changed, but, for the precent, it is thought to be completely adequate. In the following work areas one air sample par week (or two or three samples per week, depending upon the nature of the work) will be taken:

(1) Building 9206

- (a) Room # 6 (Burning of uranium chips)
- (b) Room # 26 (Q pocket disassembly)
- (c) Room # 32 (d) Room # 34, (Peroxide Precipitation Process)

(Carbon Burning)



- (e) Room # 35 (R Pocket Scraping) (f) Room # 41 (Calcination Process)
- (g) Room # 51 (Vapor Phase Chlorination)
- (h) Miscellaneous general room concentrations.

(2) Euilding 9204-3

- (a) lst. Floor Repair Area(Assembly of Receivers)
- (b) Chemical Recovery Area (Disassembly of Receivers)
- (c) Miscellaneous general room concentrations.

(3) Building 9212

- (a) Room # 44D (Batch Preparation)
- (b) Room # 44D (Unloading Reactor)
- (c) Additional rocms in Wing D (To be determined once the new machining operations get underway)
- (d) Room # 52A (Milling Green Salt)
- (e) Room # 52B (Milling Green Salt)
- (f) Miscellaneous general room concentrations.

(4) Building 9733-3

- (a) Room # 17 (Milling Samples)
- (b) Miscellaneous general room concentrations

(5) Building 9733-4

- (a) Ignition Room # 1 (Igniting Samples)
- (b) Ignition Room # 2 (Igniting Samples)
- (c) Laboratory # 1 (Sample Fuming)
- (d) Laboratory # 3 (Sample Fuming)
 (e) Laboratory # 4 (Sample Fuming)
 (f) Balance Room # 2 (Sample Weighing)
- (g) Miscellaneous general room concentrations

(6) Building 9766

- (a) Tool Grinding Crib
- (b) Vertical Milling Machine (Machining Uranium)
 (c) Horizontal Milling Machine (Machining Uranium)
- (d) Turning Lathe
- (a) General Room Concentrations
- (f) Additional Rooms in the building (To be determined once the "canning" operation gets underway).

A total of twenty eight (28) air samples were taken during this period in Bldg. 9212, 9766 and 9206 with the following results:

(1) Building 9212

- Two (2) above-tolerance concentrations were obtained in the following locations:
- (a) Room # 52A (Dumping Green Salt from Ball Mill following milling). It was immediately recommended that the operator wear a Dustfee Respirator while preforming this operation.



Meanwhilt steps were also immediately taken to confine the operation to a dry box. The final decision has not yet been determined as to just how this is to be accomplished.

(b) Room # 51A (Dumping Green Salt from Ball Mill following milling). See above

(2) Building 9766

No above-tolerance concentrations were obtained.

(3) Building 9206

No above-tolerance concentrations were obtained.

c. Water Survey

A routine schedule of water sampling (potable water, process water and sewage) is under consideration and will be put into effect when the sampling points and frequency of sampling have been determined.

No potable water samples were taken during this period.

2. Special Surveys

a. Clothing Contamination Survey

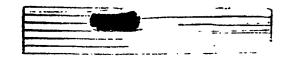
The Health Physics Group has been charged with the responsibility of determining the departments for which protective clothing will be provided in the future. Since it is to be the policy of the group to recommend protective clothing only on the basis of uranium exposure and not for general industrial hazards, an effort is being made to determine the extent of such exposure by clothing counts. A reproduction of the Alpha Clothing Counter used at Oak Ridge National Laboratories has been fabricated and installed in the laundry. Clothing counts are being taken daily and, when sufficient data has been accumulated, definite recommendations will be made.

b. Ammonium Ditubylate ((NH4)2 U2 07) Sample

The Analytical Laboratory received this sample for purposes of analysis from Oak Ridge National Laboratories. Measurements of the beta and gamma activity were taken and recommendations for handling the sample in the laboratory were provided. Although the activity measured was well over 200 mr/hr, no above-tolerance exposures were experienced as indicated by film and instrument monitoring

c. Radiation Checks for Shipment of Property

Two hundred seventy-five (275) lets of equipment were checked for alpha, beta and/or gamma activity in accordance with Standard Practice Procedure #20A for release of property for shipment from Y-12.





3. Radiation Monitoring Instruments

- a. Two (2) each Cutie Pies and Zeutos were received during the period.
- b. Beta, Gamma Hand and Foot Counter The chassis is completed and assembly of the instrument has begun. There are some electronic parts still to be procured.
- c. Air Proportional Alpha Hand Counters The first completed counter has been tested and calibrated. Three additional counters will be completed and installed within the next period.
- d. Clothing Counter This instrument was built and installed in the laundry for checking on clothing contamination (see 2a, above)
- e. Weston Densitometer In view of the apparent need for increased film monitoring, an order for the Weston Densitometer has been placed with the AEC Instrument Branch. To facilitate the use of film pads, a cutting die for cutting the film and sealing the pad is being fabricated and should be ready for use within the next period. Once these two items of equipment are secured, it is planned to process all our film exposures at this site.

4. Personnel

A significant development during this period has occurred in the decision to enlarge the group. After a thorough study of the needs as they now appear, it was decided to inaugurate a new job classification, viz., radiation inspector, whose duties will consist largely of field measurements. It is hoped that such additional personnel as are needed at present will be brought into the group within the next period.

Following is a list of Department Personnel:

- J. D. McLendon
- J. W. Morfitt
- R. L. Murray
- E. G. Strumess

Others participating in the radiation measurement program are:

Instrument Development:

- R. L. Quinn
- E. L. Olson

Instrument Repair and Calibration:

- J. H. Campbell
- V. Lovett

Shipment Surveys:

J. W. Ebert

J. H. Hackney

Y-12 Special Hazards Group

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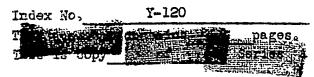
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CARBIDE AND CARBON CHEMICALS CORPORATION Y-12 PLANT

HEALTH PHYSICS PROGRESS REPORT January 1 - 31, 1948

Raymond Murray

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HEALTH PHYSICS PROGRESS REPORT January 1-31, 1948

L. Endiation Survey

Health Physics activities in the Y-12 Plant during this period were concerned chiefly with air surveys, film monitoring of personnel in Elde. 9766 Machine Shop, engineering and expediting the fabrication of eight (8) Air Proportional Alpha Hand Counters, and routine water surveys. The results are summarized below:

a. Fersonnel Monitoring

(1). Hand Counts

The Air Proportional Alpha Hand Counter was used exclusively in the Machine Shop of Bldg. 9766. Hand counts were recorded twice daily, before lunch and at the end of the work day. The records show counts ranging from background to 1500 counts per minute with the median count at about 125 counts per minute. Due to the nature of the work in this area, it is impossible to foresee much improvement in hand contamination until leather gloves, which can be worn while taking machined measurements, are procured. An effort is being made to get a kid-leather type glove which may meet the requirements. Meanwhile, the employees are required to: (1) take special care in washing their hands before eating or smoking; (2) abstain from smoking, eating, chewing tobacco, etc., while at work in the area; and (3) bathe at the end of each work day.

AEC Alpha Hand Tolorance - In light of the results of the hand count survey, it was clearly indicated that hand counters were needed and, therefore, efforts were expended to procure them as quickly as possible. Associated with the need for instruments was an equally urgent need for inquiring into the practicability of the AEC alpha hand contamination tolerance level of 0 disintegrations/minute from an area of 150 square centimeters. Investigations to that end revealed that such a tolerance level for use in a uranium separation plant was not only unreasonable, but highly impractical. All of which resulted in the dispatch to the Atomic Energy Commission on January 28 of a request for an interpretation of the tolerance level for alpha hand contamination.

(2). Film Monitoring

Approximately eighty (80) film pads were used in the Machine Shop of Bldg. 9765 during the month. The film rad, which consists of a disc of Dupont 552 film sealed in rubber, was secured to the palm of the hand in an attempt to measure exposure to uranium metal surface which is known to give approximately 270 mr/hr of beta and gamma radiation of which 5 mr/hr is gamma radiation. The Health Physics Division at Clinton National Laboratories has cooperated in this program to the extent that they have provided the film pads and have developed the exposures and run the calibrations.



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All of the employees, who must of necessity come in contact with the metal, were checked regularly during the various phases of their operations. Thirty-five of the film discs revealed exposures slightly in excess of the 100 mrep allowable exposure. Investigations as to the causes of these over-exposures have shown that carelessness in the matter of wearing gloves is largely responsible and steps have been taken to correct the situation. Detailed records of daily exposures are being maintained and routine film monitoring will continue. Some thought has been given to the protable need for using Pocket meters in conjunction with the film monitors. However, until further exposure data has been obtained, it is felt that film monitoring is adequate.

b. Air Survoy

The plant-wide survey of air-borre contamination has proceeded at an accelerated pace during the month such that completion of the survey is anticipated within the next period, after which the manner in which routine sampling is to be done can be definitely established. A total of sixty-five (55) air samples were taken in Bldgs. 9212, 9766, 9206 and 9204-3 with the following results:

(1) Building 9212

No above-tolerance concentrations were obtained.

(2) Building 9766

No above-tolerance concentrations were obtained.

(3) Building 9206

Three (3) above-tolerance concentrations were obtained in the following location:

(a) Room 32 (Eatching Malincrodt Oxide and the Peroxide Precipitation Process). This is an intermittent operation, i.e., it occurs about 5 times per month; it is also of short duration (approximately one hour) and the operators are required to wear Dustfee Respirators.

(4) Building 9204-3

No above-tolerance concentrations were obtained, although one sample taken in the Servicing Area during the assembly of receivers with used parts indicated the need for further sampling.

c. Potable Water Survey

Sevon (7) samples of potable water taken in Bldgs. 9201-4, 9720-1, 9720-5, 9723-4, 9709, 9738 and 9940 and enalyzed in the Industrial Hygicae Section at K-25. All results for this month continue to Indicate that there are no hazards resulting from water contamination in the Y-12 Area. The initial survey is now considered as completed and a routine water survey program is being schedulod. It is planned to establish sampling points, frequency of sampling, the method of





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analyses, etc., on a routine basis as soon as it is possible.

2. Special Surveys

a. X-Ray Shielding Requirements for High Voltage Supply in Bldg. 9204-3

Thirty-five (35) Eastman Tri-pak film packets were exposed at strategic locations to X radiation in the 100 KV "G" supply on Track #6 of Bldg. 9204-3. Results indicated that the 1/8" steel shielding was adequate except in locations where grill work was provided to facilitate cooling. Recommendations concerning the manner in which personnel are to be safeguarded during the operation of this high voltage source were submitted to the departments concerned and additional checks will be made to determine more accurately the additional safeguards required.

b. X-Ray Shielding Requirements for High Voltage Supply in Bldg. 9731

The lack of data regarding the efficiency of X-ray production in KC-h rectifiers, 562 and 893 electronic tubes has made it difficult to prescribe shielding requirements for high voltage supplies. However, in light of the test results mentioned in item 2-a above, it was recommended that 1/8" steel panels be provided on all sides and on the ceiling above the high voltage installation in Bldg. 9731. Periodic checks will be made to ascertain shielding efficiency.

c. "Canning" Operation Hazards

The hazards involved in the machining, annealing and dipping of uranium slugs have been studied and recommendations have been made. It is thought that special exhausts will not be required for the lathes providing the general ventilation is adequate.

d. Radiation Checks for Shipment of Property

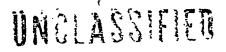
One hundred and thirty-three (133) lots of equipment were checked for alpha, beta and/or gamma activity in accordance with Standard Practice Procedure #20A for release of property for shipment from Y-12.

3. Radiation Monitoring Instruments

- a. Cutic Pies and Walky Poppy, previously reported as being on order, have not yet been received.
- b. Bets, Janua Hand and Foot Counter The chassis is about completed.

 It appears that procurement of capacitors and transformers may project the completion date of the electronics unit beyond the next two months.
- c. Air Proportional Alpha Hand Counters In the modification of Process Monitors into the electronics units for these counters and subsequent testing, it has been found that many of the condensers are overloaded and will have to be replaced. There is also a special high voltage transformer for which there is no standard substitution, all of which will delay installation of the counters. However, a special







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effort is being made to get into service in the next month at least three hand counters; it is planned to install the first two in Bldg. 9212 and the third in Bldg. 9206.

Fabrication of the Ionization Chambers is proceeding according to schedule with little, or no limitation in the procurement of parts.

4. Personnel

Following is a list of Department Personnel:

- J. D. McLendon
- J. W. Morfitt
- R. L. Murray
- E. G. Struxness

Others participating in the radiation measurement program are:

Instrument Development:

- R. L. Quinn
- E. L. Olson

Instrument Repair and Calibration:

- J. H. Campbell
- V. Lovett

Shipment Surveys:

- J. W. Ebert
- J. H. Hackney

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Y-12 PLANT

HEALTH PHYSICS PROGRESS REPORT Docember 1 31 1947

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G. Dr. P. D. Scoffeld
4-7. Im. Ned Williams
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RO-11. C. R. I. O.

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HEALTH PHYSICS PROGRESS REPORT December 1 - 31, 1947

1. Radiation Survey

Health Physics activities in the Y-12 plant during this period were, for the most part, centered around the start-up of the New Machine Shop in Building 9766. Hand counts, surface checks, and air and water surveys associated with the overall preliminary survey were carried out as time and equipment permitted. The results are summarized below:

a. Hand Counts

The Air Proportional Alpha Hand Counter was used in Bldg. 9212 for the first eighteen days of the month to check on the effectiveness of the newly revised glove and handling techniques instituted at the start of month. The revisions essentially involve more delicate laboratory methods and accepted surgical glove techniques. A vast improvement was noted almost immediately. Counts taken on a typical day prior to installation of the new methods showed hand counts ranging from background to 7000 counts per minute with a median count of 1000 counts per minute. Those recorded on the eighteenth day after installation showed counts ranging from background to 700 counts per minute with the median count at 150 counts per minute.

With the start up of the Bldg. 9765 Machine Shop, the Hand Counter was moved to that location for purposes of checking on hand contamination in the machining of uranium. The Hand Counts recorded to date, while they are comparatively low (averaging about 175 counts per minute), are still higher than current tolerance levels will allow and efforts are therefore being made to establish adequate handling and glove techniques before operations get too far underway.

b. Air Survey

Thirty-six (36) air samples were taken in the new machine shop of Bldg. 9766. Of the twenty-two air samples taken at breathing levels, only one showed a uranium concentration seriously approaching the chemical toxicity tolerance of 150 / g/M³, i.e., 76.7%. This same sample gave 354 / s/minute/M³ which is but 28.9% of the 1225 / s/minute/M³ radiation m.à.c.

Sampling tests of air-borne concentrations will continue on a routine basis until all operations, all factors affecting them and the possible changes to be made, are sufficiently well known to give the data required to draw accurate conclusions.

Four (4) air samples were taken in the following locations of Bldg. 9206:

(1) Room #32 - batching dry Mallinckroft Oxide in the Peroxide Precipitation Process.



- (2) Room #41 Dumping calcined oxide from calcining pans into a 55 gal. drum.
- (3) Same as (2) above.
- (4) Room #34 "R" carbon scraping.

The first three samples showed uranium concentrations far in excess of the accepted tolerance levels. These operations, however, are performed intermittently (from twice a week to 5 times a month) and are of such short duration, i.e., periods ranging from 5 to 30 minutes, that the dust respirators which are used appear to provide adequate protection. Medical has been requested to make some tests to accurately establish the efficiency of these respirators.

c. Potable Water Survey

Thirteen (13) samples of potable water, taken in Buildings 9735, 9203, 9711-5, 9712, 9737, 9754, 9720-2, 9723-4, 9720-1, and Clear wells #1 and #2 of the Filter Plant, have been sent to the Industrial Hygiene Section at K-25 for analysis. Results of the analyses of the nine received to date show no uranium contamination.

2. Radiation Monitoring Instruments

a. The Cutie Pies and Walky-Poppy, previously reported as being on order, have not yet been received.

b. Beta, Gamma Hand and Foot Counter

Sheet metal parts for the chassis are being fabricated in the K-25 Machine Shop. Parts for the electronics unit have been placed on order.

c. Air Proportional Alpha Hand Counter

AEC was unable to secure drawings of the Chicago Counter, but provided drawings of the counting chambers used in the Hanford Four Fold Counter instead. They are now in the Electrical Instrument Shop where they will be fabricated. The Process Monitors, being similar electronically, are being modified to conform to the electronics unit of the Chicago Hand Counter by the Instrument Shop. Therefore, it is expected that additional Hand Counters will be put into use during the next month.

3. Special Equipment Surveys

a. Radiation Checks for Shipment of Property

Two hundred and ninety-six (296) lots of equipment were checked for alpha, beta and/or gamma activity in accordance with Standard Practice Procedure #20A for release of property for shipment from Y-12.





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b. Charge Bottles Sent to Machine Shop

Upon request of J. M. Case, twenty-six (26) charge bottles, which had been sent to the shop to be cut into halves, were checked for activity level. Twelve of the bottles were found to be highly contaminated, i.e., one bottle gave 200 mr/hr at the outside surface. It was recommended that the bottles be sent to the shop in Bldg. 9204-3 where this work is normally done and steps are being taken to control the handling of these bottles with appropriate care in the future.

5. Personnel

Following is a list of department personnel:

- J. D. McLendon
- J. W. Morfitt
- E. G. Strumess
- R. L. Murray

Others participating in the radiation measurement program are:

Instrument Development:

- R. L. Quinn
- E. L. Olson

Instrument Repair and Calibration:

- J. H. Campbell
- V. Lovett

Shipment Surveys:

- J. W. Ebert
- J. H. Hackney

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HEALTH PHYSICS PROGRESS REPORT November 1 - 30, 1947

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Distribution, Series A:

- l. Mr. C. N. Rucker
- 2. If. C. E. Center
- 3. Dr. P. D. Schofield
- 4-7. Mr. F. H. Belcher
- 8-9. Mr. R. L. Murray
- 10-11. C. R. I. O.

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HEALTH PHYSICS PROGRESS REPORT November 1 - 30, 1947

1. Preliminary Radiation Survey

Hand counts, surface checks, and air and water surveys are being continued. The results to date are summarized below.

a. Hand Counts

The Hand Count Survey has been completed and a detailed report is being prepared for distribution. In addition to the locations previously reported on, hand counts were taken in Buildings 9720-2 and 9212 (Laboratory Group). The counts of tool attendants and warehouse employees in 9720-2 show little or no hand contamination in their handling of used tools. The counts of the Laboratory Group in 9212, as was shown in similar groups of Buildings 9733-1, 2, 3 and 4, show that general laboratory technique is effective in confining hand contamination to a minimum.

b. Air Survey

Upon request of the Medical Department, a survey is being made of the extent to which laboratorians and metallurgists are being exposed to calcium oxide and beryllium oxide. To date, seven air samples, the analyses of which have not yet been completed, have been taken in the following locations:

- (1) Three BaO contamination air samples in the Metallurgical Laboratory of Building 9766.
- (2) Three CaO contamination air samples in Rocm #45C of Building 9212.
- (3) One BeO contamination air sample in Room #45C of Building 9212.

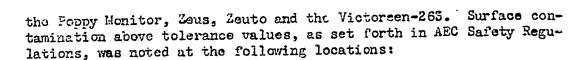
c. Potable Water Survey

Fourteen (14) samples of potable water taken from Buildings 9733-3, 9733-4, 9731, 9735, 9739, 9766, 9204-3 and 9212 have been sent to the Industrial Hygiene Section at the K-25 plant for analysis. One sample, taken from the Chemical Recovery area in Building 9204-3, showed radicactive contamination to within 40% of tolerance. Twelve additional samples were taken from the same source, four of them being sent to K-25 for analysis, four to Analytical Laboratories at Y-12 and four to the Spectroscopy Laboratory at Y-12. Results of the analyses at Y-12 have not yet been completed. The analyses of the four samples sent to K-25 indicate that no contamination is present and that the bottle of the original sample was probably contaminated. To prevent a recurrence of this sort, sample bottles are now cleaned and checked for contamination at K-25 and then sent to Y-12 for use in taking the samples.

d. Surface Checks

Buildings 9733-3, 9733-4 and Wing B of 9212 have been surveyed with





- (1) All "fuming" hoods used in Building 9733-4.
- (2) Crucible Trays used in Ignition Rooms #1 and #2 in Building 9733-4.
- (3) The Muffle Furnace Hoods and Infra-Red Hoods of Ignition Rcoms #1 and #2 in Building 9733-4.
- (4) The concrete floor in the southwest corner of Room #1 in Building 9733-4.
- (5) Table surface under and around the Ball Mills in Room #14 of Building 9733-3.
- (6) Muffle Furnace Hood in Rcom #14 of Building 9733-3.
- (7) Wooden guard rail in northeast corner of Room 47B of Building 9212.
- (8) Muffle furnace back-plate found on laboratory table in Room 49B of Building 9212. This plate, not being standard equipment in this laboratory, was immediately removed.

2. Radiation Monitoring Instruments

- a. Because of an unpredictable delivery date on the Alpha and Beta Hand and Foot Counters, previously reported as being on order, it was decided that the order be withdrawn and steps taken to have them fabricated at this site. Drawings of the Beta Hand and Foot Counter have been procured and are now in the hands of the Engineering Department. To date, the drawings of the Alpha Hand Counter have not been received.
- b. The Cutie Pies and Walky-Poppy previously reported as being on order, have not yet been received.
- c. An extension, for use with the Poppy Moniter in surveying floors, has been fabricated and is now in use.

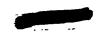
3. Special Equipment Surveys

a. Radiation Checks for Shipment of Property

Three hundred and fifty-three (353) lots of equipment were checked for alpha, beta and/or gamma activity in accordance with Standard Practice Procedure #20A for release of property for shipment from Y-12.

4. General

In anticipation of problems likely to arise with respect to the disposal of radioactive wastes, a meeting of representatives of Health Physics groups from X-10, K-25 and Y-12 was held at Y-12 on November 11, 1947. This





meeting was called at the suggestion of Dr. Paul Tompkins, Clinton National Laboratories, in light of the fact that activities in Building 9207 are beginning to get underway. In preparation for the meeting, the Engineering Department made a survey of the storm and sanitary sewers in Y-12 area and samples of process wastes from Buildings 9732-1, -2 and -3 and Building 9212 were analyzed. Conclusions reached at this meeting were as follows:

- (1) Operations in the C&CCC Plant of Y-12 Area, as now constituted, will not cause activity levels in the storm sewer to approach tolorance values.
- (2) Periodic activity checks of storm sewer samples will be made to determine the extent of the activity.
- (3) Laboratories in Building 9207 will have to devise ways and means, with the aid of constant monitoring, to keep the activity in the storm sower below 10-5 microcuries per cubic centimeter.

5. Personnel

Following is a list of department personnel:

- J. D. McLendon
- J. W. Morfitt
- E. G. Struxness
- R. L. Murray

Others participating in the radiation measurement program are:

Instrument Development:

- R. L. Quinn
- E. L. Olson

Instrument Repair and Calibration:

- J. H. Cumpbell
- V. Lovett

Shipment Surveys:

- J. W. Ebert
- J. H. Hackney

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Y-12 Special Hazards Group

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HEALTH PHYSICS PROGRESS REPORT September 1 - 30, 1947

1. Routine Radiation Surveys

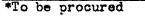
In the past there have been no complete radiation surveys on a routine basis in this plant, i.e., activity measurements have been made only upon special request. During the month of September, plans were completed for a plant-wide radiation survey upon which to base future routine work. It is thought that the greater part of this initial test will be completed in the next two months.

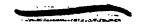
This preliminary survey will consist of hand counts, surface checks, air and water surveys, special equipment surveys and personnel monitoring in ten of the process and development buildings.

2. Radiation Monitoring Instruments

A pool of the following instruments has been established in the B-3 Instrument Laboratory of Bldg. 9735:

	Instrument	Type	Range of Intensity
a .	Alpha Detectors		
	Howler Parallel Plate	Proportional Counter	10 - 30,000 < s/minute
	Counter	Ionization Chamber	$20 = 20_{p}000 \propto 's/minute$
	AM-1	Ionization Chamber	$60 - 40,000 \propto 1 \text{ s/minute}$
	Zeuto	Ionization Chamber	$300 - 30,000 \propto 1 \text{s/minute}$
	Poppy	Proportional Counter	10 - 100,000 x 's/minute
	Hand Counter	Proportional Counter	20 - 100,000 \s/minute
	*Walkie Poppy	Proportional Counter	Qualitative
b.	Beta and Gamma Detect	ors	
	Victoreen-263	Geiger-Mueller Tube	0.025 - 20 mr/hr
	Minometer Chambers	Electrometer & Ion Chamber	3 - 100 mr
	*Cutie Pie	Ionization Chamber	5 - 5,000 mr/hr
	L & W Survey Meter	Electrometer & Ion Chamber	125 - 125,000 mr/hr
	Film Badges	K,M,5302 & 6567	0.07 - 1,200 r
c.	Alpha, Beta and Gamma	Detectors	
	Zeus	Ionization Chamber	2 - 2,500 mr/hr
d.	Neutron Detectors		
	Slow Neutron Pocket Meter	Electrometer & Ion Chamber	2,000 nv/8hrs.
	Neutron Counter	Boron-lined Propor-	,
		tional Counter	$10 - 40_{\rho}000 \text{ n's/minute}$





3. Special Equipment Surveys

a. Used Parts Exhibit

The contents of two-glass-enclosed cases located at the west end of the Parts Laboratory in Bldg. 9739 were examined with standard instruments and methods of detection. It was found that no personnel hazard existed while the parts were glass-enclosed. Recommendations pertaining to the handling of these parts were made to the Engineering Group in an effort to reduce exposure to a minimum.

b. Alpha Tank Survey

The extension of development activities to Bldg. 9204-1 indicated the need for a radiation survey of the insides of the tanks in that building. Four tanks (625, 627, 629, and 631), two of which had been purged of surface contamination, were surveyed. An above-tolerance exposure was found in three of the four tanks, i.e., 625, 627 and 629, and recommendations are being prepared for use whenever it becomes necessary to enter the tanks.

c. Oliver Filter Units

Four Oliver Filter units, scheduled for shipment off the area from Bldg. 9202, were surveyed for outside surface contamination. An additional survey was made of the truck in which they were to be transported (after loading) to make certain that the occupants of the truck cab would not be subjected to hazardous exposure.

d. Radiation Checks for Shipment of Property

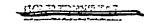
In accordance with Standard Practice Procedure #20A, which specifies that radiation checks must be made before releasing property for shipment from the Y-12 area, the following items were checked for alpha, beta and/or gamma activity:

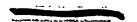
- (1) Nine vehicular trucks
- (2) One side crane tractor
- (3) Twenty-three power units, e.g., welders, pumps, loaders, light plants, etc.
- (4) Surplus firemen's uniforms
- (5) Miscellaneous items

4. Personnel

Following is a list of department personnel:

- J. D. McLendon
- J. W. Morfitt
- E. G. Struxness
- R. L. Murray





Others participating in the over-all radiation measurement program are:

Instrument Development:

R. L. Quinn

E. L. Olson

Instrument Repair and Calibration:

J. H. Campbell

Shipment Surveys:

J. W. Ebert

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Y-12 Special Hazards Group

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1-2 Mr. C. N. Rucker 3 Dr. C. R. Sullivan 4-7 Mr. F. H. Belcher 8-9 C. R. I. O. 10-11 R. L. Murray

Central Reports & Information Office October 16, 1947

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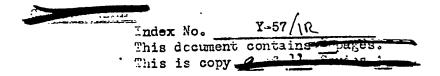
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HEALTH PHYSICS PROGRESS REPORT October 1 = 31, 1947

'Raymond Murray

Oak Ridge, Tennessee November 12, 1947

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HEALTH PHYSICS FROGRESS REPORT Optober 1 - 31, 1047

1. Proliminary Radiation Survey

Hand counts, surface checks, and air and water surveys are being conducted concurrently. Results of this surrey to date are surmarised belcw.

a, Hand Counts

Except for a few isolated groups still to be checked, the Hand Count Survey is completed. Some of the groups in Bidgs. 9212, 9206 and 9204-3 has a significant number of counts above tolerance.* Counts taken in Bldgs. 9201-4, 9735-1, 9733-2, 9738-8 and 9733-4 indicate clearly that no hazardous hand contamination exists.

b. Air Survey

Ten air samples, none of them showing contamination approaching tolerance values, were taken at the following locations:

(%) Room #51 (oxide to chloride conversion) of Bldg. 9206.

(2) Refining Service Area (assembly of E bexes and distasembly of H-J sub-assemblies) of Blcg 9204-3.

(3) Track Room (removing tank manifold) of Bldg. 9204-3.
(4) Chemical Recovery Area (disassembly of E units) of Bldg. 9204-3.

(5) Lunch Room of Bldg. 9204-3.

c. Potable Water Survey

Nineteen (19) samples of potable water, taken from Bldgs. 9212, 9206 9204-2, 9733-1, and 9733-2, have been sent to the Industrial Hygicas Section at the K-25 plant for analysis. Results of the Swelve analyses received to date show no radioactive contamination.

2., Radiation Monitoring Instruments

A Parallel Plate Ion Chamber Counter has been added to the Instrument Pool in Bldg. 9735. The Cutic Pier and Walky-Poppy, previously ordered have not been received. In addition, the following instruments have been placed on order:

Six (6) Air Proportional Alpha Hand Counters

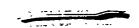
One (1) Beta-Gamma Hend and Foot Counter

3. Special Equipment Surveys

a. Radiation Checks for Shipmont of Property

Six hundred and sixty-four (664) items were checked for alpha, but a

^{*} Tolerance values, of the order of 500 c/minute, are determined principally by the specific alpha activity and retention-in-ciosus properties of the





and/or gamma activity in accordance with Standard Practice Procedure #20A for release of property for shipment from Y-12.

4. Personnel

Following is a list of department personnel:

- J. D. McLendon
- J. W. Morfitt
- E. G. Struxness
- R. L. Murray

Others participating in the radiation measurement program are:

Instrument Development:

- R. L. Quim
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Y-12 Special Hazards Group